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Macroeconomic Adjustment and Growth

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Modeling the Macroeconomic Requirements of Policy Reforms

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The macroeconomic requirements of policy reforms can be determined through an extension of the Bank's RMSM model to include fiscal and monetary variables and behavioral functions.

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WORKING PAPERS

Macroeconomic Adjustment and Growth

This paper — a product of the Macroeconomic Adjustment and Growth Division, Country Economics Department — is part of a larger effort in PRE to develop a macroeconomic projection model that will improve and extend the Bank's RMSM model. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Raquel Luz, room N11-057, extension 34303 (82 pages with figures and tables).

Easterly, Hwa, Kongsamut, and Zizek assess the macroeconomic policy regime required for structural economic reform in trade and financial policy. To do so, they develop a macroeconomic model for deriving the appropriate stance on macroeconomic policies needed to support structural reform measures in trade and finance.

The macroeconomic projection model of Colombia they use is an extension of the Bank's Revised Minimum Standard Model (RMSM) currently in use. They enrich the traditional RMSM by adding fiscal and monetary identities as well as behavioral functions for the following variables: private consumption, private investment, money demand, demand for quasi money, export supply, and import demand.

They illustrate how the *basic* model functions by comparing three simulations to a base case run, increasing the targets for three variables: the real exchange rate, the real interest rate, and the inflation rate.

All three simulations increase the financeable fiscal deficit, but in different ways. A target of real exchange rate appreciation increases it by making more foreign credit available to the public sector. Higher targets for real interest and inflation rates increase it by making more domestic credit available.

They then extend the model to take into account the external financing constraint facing the government and the economy, and by adding detail on the tax and banking systems. They use the extended model to discuss macroeconomic adjustments needed for policy reforms being considered in Colombia for trade (reduced tariff rates and relaxed import quotas), finance (reduced reserve requirements and forced investment requirements for the banking system), and reducing inflation.

All the policy reforms require fiscal adjustment to be consistent with available financing. For example, reduced tariff rates mean lost revenues, which must be compensated by revenue increases elsewhere or spending cuts. The incipient increase in import demand because of reduced tariffs requires more currency depreciation, although not as much as the increase in the tariff rate. Quota reduction also requires some currency depreciation.

All scenarios require reducing public investment if no other fiscal measures are taken. Since reducing public investment lowers growth, these simulations dramatize the need to pursue fiscal reforms that compensate for the adverse fiscal effects of trade or financial liberalization without reducing urgent social spending or investments in public infrastructure.

The model does not try to capture the favorable effects of reform on efficiency and growth, which other evidence suggests would be large enough to raise growth in the long run even if there were an ill-advised reduction in public investment.

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I. INTRODUCTION

1. The Colombia macro model presented in this paper is part of a family of macromodels being prepared by the Macroeconomic Adjustment and Growth Division in collaboration with colleagues in Operations for use in projections and evaluation of adjustment programs. These models represent a continuum of economic and programming complexity. The projection models known as RMSM-X are intended to be the successor to the Bank's RMSM (Revised Minimum Standard Model) model, with the main improvement being the inclusion of fiscal and monetary identities in addition to the traditional external balance and saving-investment identities. These models embody simple projection rules and are solved recursively to obtain whatever are defined to be the residual variables.

2. At the next level of complexity, the models known as RMSM-XX will cover the same ground as RMSM-X, but will incorporate behavioral functions for the main macroeconomic variables. They will be estimated for countries where the data and structural characteristics permit. They will be solved simultaneously to obtain relative prices that clear goods markets and financial markets. Finally the highest level of complexity will be macro models known as MACOR that will be state-of-the-art macro-econometric models.

3. The model presented in this paper is in-between RMSM-X and RMSM-XX in that--unlike RMSM-X--it does incorporate behavioral functions for the main macroeconomic variables, namely private consumption, private investment, money demand, demand for quasi-money, export supply, and import demand. However, unlike RMSM-XX but like RMSM-X, it is solved recursively for residual

variables. The user specifies "target values" for the real exchange rate, real interest rate, and the inflation rate. The model then determines the public sector behavior consistent with attaining these targets. In an alternative solution, described in Appendix II, the model also permits setting exogenously the public sector variables and determining the private sector behavior necessary to reach the policy targets. Finally, the model is generalized to take into account external financing constraints by making the real exchange rate endogenous. The model is used to derive the macro adjustment required by trade and financial liberalization.

PART I: THE BASIC MODEL

II. DESCRIPTION OF THE MODEL

4. The structure of the model can be explained by looking at its three key ingredients: the accounting framework, the behavioral equations and projection rules for the variables, and the choice of residual variables to satisfy the accounting identities. Some illustrative simulations will then be presented to show how the model works.

A. Boring Accounting

5. The model uses the flow-of-funds accounting framework presented in Easterly (1989), which is consistent with the framework presented in RMSM-X examples such as Holsen (1989) and Schmidt-Hebbel et al. (1989). This framework reconciles historical data on income, expenditure, saving, investment, and financing flows of different actors in the economy. The

accounting identities are then also used as part of the projection model to ensure that budget constraints are observed for each of the sectors.

6. In this application, we use the minimum number of sectors: the consolidated public sector, the banking system,[1] the nonfinancial private sector, and the external sector. Other applications of RMSM-X may wish to consider breaking the public sector down into the budgetary and extra-budgetary accounts and distinguishing the banking system between the central bank and the rest (the latter will be done in Part II). In this application, the simplest possible sectoral breakdown seemed appropriate because additional complexity will be introduced by specifying behavioral functions for the private sector.

7. The consistent macroeconomic accounts for 1988 are presented in the matrix in Table 1 on the next page (definitions of the variables follow Table 1). A similar exercise was done for 1986 and 1987, but is not shown. The construction of this type of a matrix is detailed in Easterly (1989). Briefly, it reconciles current income and expenditure with capital expenditure and financing flows. The current income and expenditure is in the upper left-hand quarter of the matrix, with expenditure flows shown down and income flows shown across. The organizing principle of the matrix, and of the macro accounts in general, is that expenditure by one sector will be the income of another sector. In addition to the four rows and columns for the four sectors, there will be another row and column for the national accounts, which

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1/ The "banking system" is defined to include the following Colombian financial intermediaries: commercial banks, corporaciones financieras (development finance corporations), corporaciones de ahorro y vivienda (savings and loan companies), and compañias de financiamento commercial (finance companies).

1988

TABLE 1
CONSISTENCY ACCOUNTING MATRIX
RATIOS TO GDP

Sources (across) and Uses (down)	CURRENT ACCOUNT OF: Consolidated Public Sector	Banking System	Non Financial Private Sector	External Sector	National Accounts	CAPITAL ACCOUNT OF: Consolidated Public Sector	Banking System	Non Financial Private Sector	External Sector	Natl Accounts Investment (sum of previous 4 rows)	TOTAL
Consolidated Public Sector			Td 3 44%		It 11 16%						TotGovCurS
			DLhR 3 06%		Subg 0 79%						21 61%
					-DRS 4 74%						
Banking System											
Non Financial Private Sector	Tgp 3 25%			Tfp 2 28%	Yfp 84 89%						TotPriCurS
	Ng=SNgp 1 17%			NNFAcb 0 54%							92 12%
External Sector	Ngf 2 96%		Nnf@Ngf 0 46%								TotBOPCurS
	NSgf 0 04%		NSnf 0 38%								4 57%
			Nfnet -0 09%								
			Nref 0 63%								
National Accounts	Cg 8 78%		Cp 69 78%	- RG 0 85%		Ig 6 53%		Ip 14 06%		It 20 59%	GDP 100 00%
											(TotNACurS)
Saving and borrowing of											
Consolidated Public Sector	Sg 5 41%						Lsg 1 26%	Lpg 0 09%	Lfg 1 59%		TotGovCapS
								NDLg -1 03%	LSfg 0 21%		7 53%
Banking System								Nl 2 31%	Lfm 6 89%		TotFinCapS
								-QM 3 37%			9 94%
								-NDL 3 56%			
Non Financial Private Sector			Sp 14 27%			Lgp 1 00%	Imp 7 79%		Lfp 0 85%		TotPriCapS
									Dfl 0 48%		22 36%
									LSfp 0 07%		
									Rnet -0 25%		
External Sector				Sf 0 90%			NFAcb 0 86%				TotBOPCapS
							NFAof -0 13%				
							NFAd 0 17%				1 80%
National Accounts Saving -- total (sum of previous 4 rows)	Sg 5 41%		Sp 14 27%	Sf 0 90%							St 20 59%
TOTAL	TotGovCurU 21 61%		TotPriCurU 92 12%	TotBOPCurU 4 57%	GDP 100 00% (TotNACurU)	TotGovCapU 7 53%	TotFinCapU 9 94%	TotPriCapU 22 36%	TotBOPCapU 1 80%	It 20 59%	

NOTES TO TABLE 1 : VARIABLE DEFINITIONS

Current Account Variables

Cg	Government Consumption
Cp	Private Consumption
DRS	Depreciation, Interest and Retained Earnings from other Public Sector
Ngm&Ngp	Interest payments on debt to Private sector
Ngf	Public sector interest payments on External debt
NKnei	Interest payments on Capital nei
Nmf&Npf	Private sector interest payments on External debt
NNFAcb	Interest on Central Bank Reserves
NSgf	Public sector interest payments on Short Term External debt
NSpf	Private sector interest payments on Short Term External debt
OthR	Other revenues of Public sector
Prof	Profit Remittances abroad
RG	Resource Gap (Imports GNFS-Exports GNFS)
Sf	Current Account Deficit
Sg	Public Savings
Sp	Private Savings
Td	Direct Taxes
Tfp	Transfers from External sector to Private sector
Tgp	Transfers from Public sector to Private sector
Ti	Indirect Taxes
Subg	Subsidies
Yfcp	Factor Income of Private sector

Capital Account Variables

DFI	Direct Foreign Investment
Ig	Public Investment
Ip	Private Investment
It	Total Investment
Knei	Capital not elsewhere included
Lfg	External Credit to Public sector
Lfm	External Credit to Financial system
Lfp	External Credit to Private sector
Lgp	Credit from Public to Private sector
Lmg	Credit from Financial to Public sector
Lmp	Credit from Financial sector to Private sector
Lpg	Credit from Private to Public sector
LSfg	Short Term External Credit to Public sector
LSfp	Short Term External Credit to Private sector
M1	Money
NFAcb	Reserves of the Central Bank
NFAof	Reserves of other Financial Institutions
NFAd	Discrepancy term between IMF and RMSM estimates of Reserves
NOL	Net Other Liabilities of Financial System
NOLg	Net Other Liabilities of Government
QM	Quasi-money

represents factor income received from participating in production, and expenditure on the output of that production. Thus, this row and column represents the expenditure and income breakdowns, respectively, of total GDP

8. The balancing item for each sector's current account is saving, shown in the lower left-hand quarter of the matrix. This insures that current income equal current uses since the latter is defined to include saving. Thus, the totals of each of the first five rows will be equal to the total of the corresponding column of the matrix.

9. Saving is also the balancing item of the capital account of each sector, which is shown in the remainder of the matrix.[2] The lower right-hand quarter of the matrix represents the financing flows for each sector (or what is known as "below the line" for the public sector and balance of payments accounts). The upper right-hand quarter gives the fixed capital formation of each sector. The sum of investment is equated to total saving, which is the capital account equivalent of the GDP income-expenditure identity in the current account.

10. For each of the sectors, the equality of the capital account row and column says that the sum of their total uses of financing is equivalent to the total of their sources of financing, with the latter including own saving. To put it another way, the excess of investment over saving is equal to the net borrowing from domestic and external sources for each sector.

2/ This does not mean that saving is the residual for both current and capital accounts when actually estimating the entries in the matrix. Another residual variable is needed for the capital account to balance the matrix during estimation.

B. Behavioral Equations, Projection Rules, and Other Stories

11. There are three methods used to project the variables in the model, depending on what we think is most appropriate for the variable in question. The first method is to use a behavioral equation derived from standard macroeconomic theory, sometimes with the parameters estimated econometrically. The second method is a projection rule that the variable is assumed to maintain the same ratio to GDP (or some other relevant activity variable) as the estimated ratio in the base year (1989) or, in some cases, as the average of the historical years (1986-89). Finally, some variables are specified exogenously.

12. The only variables for which behavioral equations are used are private investment, money demand, demand for quasi-money, export supply, import demand, and private consumption. The ratio of real private investment to real GDP is given as a function of the real domestic interest rate. Nominal money demand also has an elasticity of one with respect to nominal GDP, as well as responding to the rate of (expected) inflation. The nominal demand for quasi-money is proportional to nominal GDP,[3] with the proportion depending on the (expected) real interest rate. Short-term external capital inflows are the residual for the private sector balance sheet. This specification implies that foreign and domestic assets are imperfect substitutes for the private sector. The expected inflation term in the money and quasi-money functions is the assumed inflation rate assumed for the projection. This can be seen also as a proxy for expected devaluation (after subtracting international inflation). Private consumption (in current prices) is assumed to be proportional to nominal disposable income (with some

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3/ In the extended model quasi-money is made proportional to wealth.

adjustments to correct for the inflation tax component of interest income and to avoid simultaneity, as described in Appendix I)

13. Goods exports are broken down into eight categories: coffee, crude oil, fuel oil, gold, coal, nickel, manufactures, and other. All but the last two are thought to depend on special factors apart from macroeconomic conditions, and so are projected exogenously in dollars.[4] Manufactures and "other" exports are each projected to have an elasticity of one with respect to real GDP and an econometrically-estimated elasticity with respect to the real exchange rate (see Appendix I).[5]

14. Goods imports are broken down into three categories: consumption goods, capital goods, and intermediate inputs. The first two categories are further disaggregated into public and private imports of those goods. Private consumption goods imports, private capital goods imports, and intermediate inputs are all assumed to have an income elasticity of one and an elasticity to the real exchange rate that is estimated econometrically. Public consumption and capital goods imports are assumed to be proportional to public consumption and investment, respectively.

15. Other variables in the model are projected using simple ratios. All of the fiscal income and expenditure variables are projected as ratios to GDP, with the exception of indirect taxes, which are specified as a combination of

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4/ Of course, commodity exports are not completely independent of macroeconomic conditions, but the amount of detail required to model them endogenously would greatly complicate the model. The assumption that we use is that the quantity exported is determined by capacity.

5/ This export supply function supposes infinitely elastic demand for Colombian products. This is because Colombia is presumed to be small relative to its market in these products.

trade taxes maintaining a fixed proportion to imports, and other indirect taxes held constant relative to GDP.

16. Financial asset variables such as private holding of government debt and net other liabilities of the banking system are projected as fixed ratios to quasi-money. The flow of credit to the private sector is projected as a fixed ratio to private investment.

17. All interest flows in the model are projected by multiplying the interest rate applicable to each kind of debt times the corresponding debt stock from the previous period. The interest rates on external debt are projected to move in line with LIBOR. The domestic real interest rate is fixed as a target rate in the model, so that the nominal interest rate will move with inflation. The interest rate on domestic government debt can be either fixed in nominal terms or set to move together with the overall domestic interest rate.

18. Since the current income and expenditure of the banking system is assumed to be zero for simplicity, the interest income and expenditure associated with assets and liabilities of the banking system is assigned to the private sector. This does not lead to any effective change in behavior if we assume that the net profits of the banking system would have been remitted to the private sector in any case. The only significant exception is the central bank (Banco de la República), but this is assumed to have profits (or losses) very close to zero.

19. This assumption will not hold if inflation is high, since the proceeds of the inflation tax would create profits for the central bank that

in the current set-up would implicitly accrue to the private sector. In the basic model, this problem is partially solved for the moment by giving the user the option to hold the government nominal interest rate fixed in simulations where inflation increases, which effectively gives the government the proceeds of the (additional) inflation tax. In the extended model, the inflation tax is separated out more precisely as a means of financing.

20. The model keeps track of financial stocks by adding each period's flow to last period's stock. The dollar foreign reserves and debt stocks are cumulated over time by adding each year's flow in dollars, then converting the stock to pesos by multiplying by the current exchange rate. This procedure will take into account the revaluation of the external debt in peso terms, but not that due to movements of the dollar vis-a-vis other foreign currencies, which is not assumed to be a major factor in the projection.

21. The real growth rate is inputed exogenously into the model as an assumption of the users in the basic model. Having real economic growth exogenous is a major simplification that allows the model to be solved recursively. The users will have to judge what growth rate is appropriate based on their knowledge of supply factors, exogenous demand shocks, etc. The model will calculate an ICOR to judge whether the growth projection is reasonable in light of the investment rate.[6]

22. The real interest rate, the real exchange rate, and the inflation rate are also inputed exogenously into the model. This can be interpreted as

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6/ In the extended model in Part II, the ICOR will be specified on the basis of historical data and the growth rate calculated endogenously. We eschew a more complicated aggregate supply function to keep the model tractable.

setting policy targets for these variables, and then solving for the requisite private or public sector behavior to meet the targets.

23. Finally, some other variables are inputed exogenously into the model because their projections are based on more detailed information than can be captured endogenously by the model. These include nonfinancial service trade, disbursements of external debt by type (except when calculated as a residual as described below), direct foreign investment flows, and population growth.

C. Residual Variables: A Tale of Two Closures

24. The user has two options as to what will be the residual variable in the national accounts identity that equates the current account balance to the excess of income over expenditure (or equivalently the equation that total saving--including foreign--equal total investment). These two options will be referred to as the "private closure" and the "fiscal closure". In the private closure, the private sector will be the residual, just as in the traditional RMSM. The behavioral equation for private consumption will be overridden by the requirement that private saving and consumption balance the national accounts identity. In the fiscal closure, the public sector will be the residual. Instead of exogenously projecting public investment, it will be the residual variable that balances the national accounts identity.

25. There are other residual variables that are chosen in a manner consistent with the first choice between private consumption or government investment as the residual as shown in Diagram I. In the private closure, foreign exchange reserves will be the residual for the balance of payments, while external net disbursements are determined exogenously. In the fiscal

closure, the change in foreign exchange reserves is determined as that necessary to meet a target ratio to imports, while net loans to the public sector will be the balance of payments residual. In both cases, the current account deficit of the balance of payments is determined by the export and import behavior as a function of the real exchange rate and the relevant activity variables. This must be consistent with the excess of expenditure over income, or investment over saving.

Diagram I

Private and Fiscal Closures

	Residual Variable in:			
Closure:	National Accounts Identity	Balance of Payments	Monetary Identity	Other
Private	Private Consumption	Change in Foreign Exchange Reserves	Credit to Private Sector[7]	Private credit to govt. is residual for government financing
Fiscal	Public Investment	Change in Public Foreign Debt	Credit to Public Sector	Net short-term foreign capital flow is residual for private sector capital account

26. The residual for the flows of the banking system is also determined in a manner consistent with the closure. In the private closure, the residual variable to balance sources and uses for the banking system is credit to the private sector. In the fiscal closure, it is credit to the public sector that is the residual variable. In this latter closure, for example, money and quasi-money demands (and other asset demands) are determined as functions of

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7/ It would also be possible to make credit to the public sector the residual in this case, which would be more consistent with IMF-style financial programming.

the real interest rate and inflation, private sector credit demand is determined as a ratio to private investment, and credit to the public sector is the residual.

27. Finally, there will be two other variables that are calculated differently under the two closures. Under the private sector closure, net private short-term foreign capital flows are projected exogenously, while under the fiscal closure they are the residual for the private sector capital account. Correspondingly, the change in private sector holdings of government debt are the residual for the public sector capital account under the private closure, while they are determined as a fixed ratio to quasi-money in the fiscal closure.

28. Depending on the closure, the model answers two potential hypothetical questions. Under the residual private sector option, the projection answers the question "what level of private consumption (and saving) is consistent with given targets for the real exchange rate, the real interest rate, and inflation?" Under the residual public sector option, the model answers the question "what level of public investment (and public deficit) is consistent with these targets?" In most cases, the derived levels will need to be evaluated and if found unreasonable, the model will have to be solved again until reasonable values are obtained.

29. The user will have to decide which closure is more appropriate to particular circumstances. The private sector closure has the advantage that the budget variables can be exogenously projected in accordance with stated government intentions. The disadvantage is that there is no way to evaluate within the model how or why the required change in private saving is going to

occur. The fiscal closure has the advantage that the private sector is assumed to conform to well-established behavioral rules. The model can then give the required government deficit to attain the desired targets, which can be used as a guide to government budget policy. Since the public sector closure has a more transparent economic interpretation, it will be the one used in the main text of this paper. The results of the private sector closure will be presented in Appendix II for comparison.

D. The economics of the fiscal closure

30. It is difficult in this model, with its complicated accounting and its residual closure rules, to visualize the underlying economic structure. Since the economic structure is simpler than the solution methods, it would be useful to keep it in mind during the subsequent discussion of the simulations. In this section, we summarize the economic intuition underlying the model with a core model that glosses over the accounting details to focus on the relationship between fiscal and monetary policy and the "target" variables--the real exchange rate, real interest rate, and inflation rate. We first discuss how these variables would be determined endogenously, and then how targets for these variables could be achieved. This will serve as an economic justification for the "fiscal closure" cited earlier.

31. There are three basic relations in the core model. The first relation is the condition for equilibrium in the goods market, which requires the current account deficit, as given by net imports and debt interest, to be equal to investment less national saving:

(1) $$M(\overset{+}{e}) - X(\bar{e}) = I_p(\bar{r}) + I_g - S_p - S_g$$

where M and X are import and export functions of the real exchange rate e (up is appreciation), I_p is private investment as a function of real interest rate r, I_g is government investment, S_p and S_g are private and government domestic saving respectively.

32. The signs given are those of the function with respect to the arguments. We assume that the economy produces a domestic good, which is an imperfect substitute for international goods, and an export good. The real exchange rate P/E (with P the domestic price, E the exchange rate, and the price of foreign good =1) is the relative price of the domestic good with respect to the foreign good. Thus imports are a positive function and exports a negative function of this relative price. Equation (1) implies an inverse relation between e and r to maintain equilibrium in the goods market. A real depreciation (decrease in e) creates excess demand for domestic goods which must be offset by a rise in the real interest rate to lower private investment expenditure. The real exchange rate e could vary either because of a change in the nominal exchange rate E or in domestic prices P. Since domestic prices will be determined below, the nominal exchange rate should be thought of as the endogenous variable. Colombia follows a crawling peg where the reaction function of the authorities is flexible enough to accomodate shifts in macro fundamentals such as those represented by this model.

33. The other two relations are for equilibrium in two of the three asset markets. The three assets in the core model are high-powered money, domestic debt, and foreign debt. We look at the equilibrium conditions for money and

domestic debt. High-powered money is the liability of the central bank, which must be equal to central bank assets:

$$(2) \qquad DC_g + E \cdot R^* = h \cdot P \cdot QM(\overset{+}{r}, \bar{\pi}) + P \cdot H_p(\bar{\pi})$$

34. Central bank assets include credit to the government DC_g and foreign reserves $E \cdot R^*$. Central bank liabilities include reserves against the nominal value of quasi-money ($P \cdot QM$) at the reserve ratio h and nominal currency holdings $P \cdot H_p$. Real quasimoney QM is a positive function of the real interest rate r and a negative function of the inflation rate π. The latter effect is because r is the real loan rate, so that a higher inflation rate for a given r implies a lower real deposit rate through the implicit tax from the reserve requirement. Real currency demand H_p is a negative function of inflation.

35. Equilibrium in the money market implies a negative relation between interest rates and inflation. The inflation rate is the change in P and expectations are static, so that higher P means higher π. The value of nominal currency holdings $P \cdot H_p(\pi)$ will decrease with a fall in P (and π) as long as we have not passed the maximum point of the inflation tax Laffer curve. For a given stock of domestic credit to the government (DC_g) and international reserves R^*, the real interest rate must rise to maintain equilibrium in the demand for high-powered money by raising demand for bank reserves against quasi-money.

36. The equilibrium in the debt market is for holdings of quasi-money (less reserve requirements) to equal public (L_g) and private (L_p) credit from the rest of the banking system:

(3) $(1-h) \cdot QM(\overset{+}{r}, \bar{\pi}) = L_p(\bar{r}) + L_g$

37. As already mentioned, quasimoney is a positive function of the real interest rate r and a negative function of the inflation rate. Private credit is a negative function of the real loan interest rate r. This implies a positive relation between the real loan rate and the inflation rate to equilibrate the debt market. An increase in inflation will lower quasimoney demand, which will require an increase in the real loan rate to maintain equilibrium in the credit market.

38. These three relationships will determine the endogenous variables r, e, and π for values of the exogenous policy variables I_g, DC_g, and L_g. Government foreign borrowing and private external capital flows are implicitly determined as a residual, since by Walras' law the market in foreign assets must clear once the other markets clear. Diagram II shows diagrammatically the determination of equilibrium at point A. The first quadrant shows the money and debt equilibria (equations 2 and 3), which determine jointly the inflation rate and the real interest rate. The real interest rate determines private investment. Since public investment, private saving, and public saving are insensitive to the real interest rate, this determines the investment-saving gap, i.e. the current account deficit. This in turn determines the real exchange rate that yields export and import behavior consistent with that current account deficit (equation 1) as shown in quadrant 2 of diagram II.

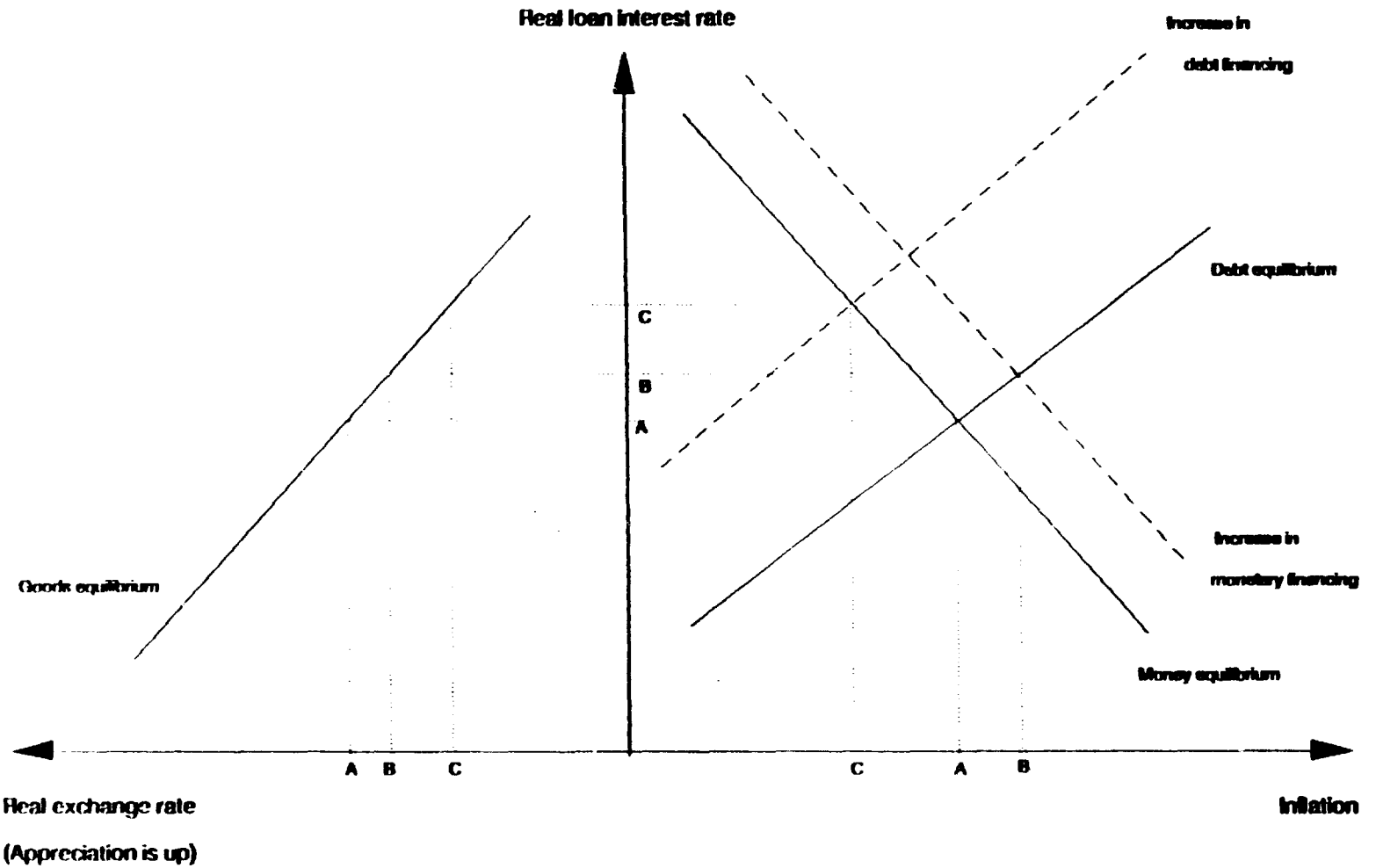
39. Comparative statics with this simple model can give some insight into the economic intuition behind the functioning of the larger macro model. An increase in monetary financing (rise in DC_g) will shift out the money

equilibrium curve in diagram II, moving the equilibrium from A to B. Higher money creation increases inflation, as we would expect from standard monetarist models. It also increases the real loan interest rate slightly. This is because the higher inflation causes a drop in the real deposit rate because of the increased inflation tax through the reserve requirement, which requires a higher real loan interest rate to maintain equilibrium in the credit market. The increase in the interest rate discourages private investment, shrinking the current account deficit. This implies a real depreciation, as shown by point B in quadrant 2 of diagram II. Since the government deficit (I_g-S_g) is unchanged, the outcome is a substitution of money financing of the deficit for external financing.

40. The second comparative static exercise is an increase in domestic debt financing of the deficit (higher L_g). This shifts up the debt equilibrium, increasing the real loan interest rate and lowering inflation (point C in quadrant 1 of diagram II). The higher interest rate leads to a smaller current account deficit and real exchange rate depreciation. The outcome this time is a substitution of domestic public debt for foreign public debt.

41. This model is implicit in the simulations to be presented in the rest of the paper. However, in those simulations we will specify targets for the endogenous variables π, r, and e, and solve for the policy variables I_g, DC_g, and L_g as residuals. Thus we are inverting the equations (1), (2), and (3), but the economics is the same.

DIAGRAM II: Determination of real exchange rate, real interest rate, and inflation rate



III. HOW THE MODEL WORKS: ILLUSTRATIVE CASES

42. The functioning of the model can be illustrated by simulations in which we change the key target variables--the real exchange rate, the real interest rate, and the inflation rate. The model under the fiscal closure solves for the "financeable" fiscal deficit given the values of the target variables, as shown in Diagram II. It adjusts the level of public investment so as to make the "above the line" fiscal deficit equal the available financing.

43. We first solve the model for the base case in which the target variables are roughly unchanged from the base year, as shown in Table 2. This solution is intended to be an illustration rather than the most likely scenario.[8] We then consider three simulations, each corresponding to an increase in one of the target variables. All three simulations increase the financeable fiscal deficit, but they do so in different ways.[9] It should be noted that in all simulations the GDP growth rate is kept unchanged to dramatize the impact of alternative target variables on the size and composition of the financeable fiscal deficit. Thus the variables to

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8/ This base case (using the basic model) was run before recent developments in Colombia changed the outlook drastically. It differs from the base case in Part II (using the extended model), which was run subsequently. Although an attempt was made to have a plausible case, it should be re-emphasized that it is for illustration only.

9/ For simplicity, the model exaggerates the separability of the effects of changes in the three target variables. In a more complex model, we would take account of interrelationships such as the effect of devaluation on demand for quasi-money or on private investment.

concentrate on in these simulations are public investment, public savings, the sources (internal and external) of financing of the public deficit, and the internal mechanism leading to the observed changes rather than the impact of the observed changes on growth. In all simulations in this and the succeeding section, it should be kept in mind that the results depend on the parameter values for the behavioral functions, the estimation of which is described on the appendix.

A. Real Exchange Rate Appreciation

44. First we solve the model for a case in which the real exchange rate appreciates by 1.8 percent per year, but inflation and the real interest rate (as well as all other exogenous variables) are unchanged. Table 3 presents the difference in each variable between the exchange rate appreciation case and the base case.

45. The most dramatic change is an increase in the current account deficit of the balance of payments, which by the end of the simulation period is 1.3 percentage points of GDP higher. This is a consequence of the behavior of imports, which increase in volume, and exports, which fall in volume due to the real exchange rate appreciation. Both imports and exports fall as a ratio to GDP because of valuation effects, but exports fall much more (in a "real-life" situation this effect would not be as large since GDP might well increase due to greater public investment). The current account worsens even more because of the increase in public investment, since public sector imports of capital goods increase proportionately.

Diagram III

Functioning of the Model Under Fiscal Closure

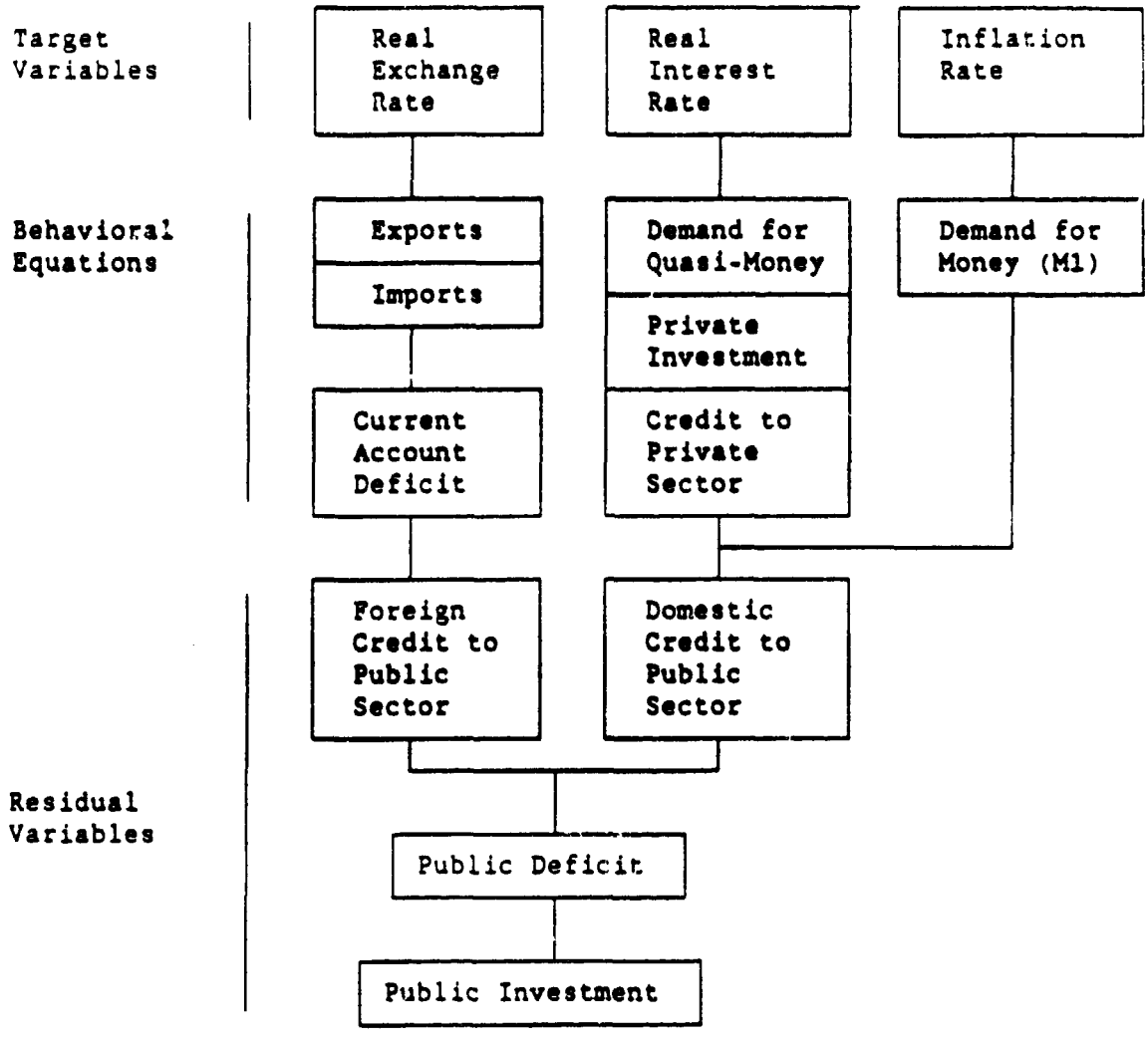

TABLE 2
MODEL SIMULATION
FISCAL CLOSURE
Base Case

	Historical		Estimated			Projected				
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
GDP Growth Rate		5.3%	3.8%	3.8%	4.0%	4.0%	4.0%	4.0%	4.0%	4.1%
Investment Growth Rate		4.1%	7.8%	-0.3%	6.8%	0.4%	1.7%	9.9%	8.8%	8.0%
Private	-15.6%	8.4%	3.0%	3.8%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Public		-13.6%	11.2%	-4.1%	13.8%	-7.7%	-4.0%	25.8%	9.8%	10.8%
GDP per capita Growth Rate				2.0%	2.0%	2.2%	2.2%	2.2%	2.0%	2.0%
Consumption per capita growth rate				0.9%	0.6%	2.4%	1.7%	1.8%	2.2%	2.2%
Gross Investment/GDP	18.0%	19.5%	20.6%	19.8%	20.3%	19.6%	19.2%	20.3%	20.6%	21.1%
Domestic Savings/GDP	21.8%	21.8%	21.4%	21.3%	21.5%	21.6%	21.6%	21.7%	21.7%	21.8%
National Savings/GDP	19.6%	19.7%	19.7%	18.5%	18.9%	19.4%	19.4%	19.7%	20.0%	20.1%
Marginal National Savings Rate	20.4%	-32.4%	18.9%	-12.6%	32.5%	32.5%	20.7%	28.9%	27.3%	24.4%
Private Investment/GDP	11.3%	13.5%	14.1%	14.1%	14.1%	14.1%	14.1%	14.1%	14.1%	14.1%
Private Consumption/GDP	69.0%	69.4%	69.8%	69.7%	69.5%	69.4%	69.4%	69.3%	69.3%	69.2%
Private Savings/GDP	12.1%	14.4%	14.3%	14.0%	14.0%	14.0%	14.0%	14.0%	14.0%	14.0%
Private Resource Balance/GDP	0.7%	0.8%	0.2%	-0.1%	0.0%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
Public Investment/GDP	6.7%	6.0%	6.5%	5.7%	6.3%	5.6%	5.1%	6.2%	6.5%	7.0%
Public Savings/GDP	7.6%	5.4%	5.4%	4.5%	4.9%	5.4%	5.4%	5.7%	6.0%	6.1%
Public Revenues/GDP	24.7%	22.7%	22.4%	22.4%	22.4%	22.4%	22.4%	22.4%	22.4%	22.4%
Public Expenditures/GDP	25.0%	24.5%	24.5%	24.7%	24.8%	23.5%	23.1%	23.9%	24.0%	24.3%
Public Deficit/GDP	0.3%	1.8%	2.1%	2.3%	2.4%	1.1%	0.7%	1.5%	1.6%	1.9%
MLT External Financing	4.4%	0.4%	1.6%	1.2%	1.8%	0.5%	0.1%	1.1%	1.1%	1.4%
ST External Financing	-2.8%	-0.3%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Domestic financing-financial system	-2.6%	2.1%	1.3%	1.7%	1.2%	1.3%	1.3%	1.1%	1.2%	1.1%
Domestic financing-private sector	0.0%	0.4%	0.1%	0.4%	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%
Residual	1.4%	-0.7%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Real exchange rate index			100.0	99.5	99.5	99.5	99.5	99.5	99.5	99.5
Real Exchange Rate Depreciation(-)				-0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Domestic Inflation		22.8%	28.4%	25.0%	23.0%	22.0%	22.0%	22.0%	22.0%	22.0%
Exchange Rate Depreciation		24.9%	23.3%	22.1%	16.6%	15.6%	15.6%	15.6%	15.6%	15.6%
Nominal Interest Rate	31.2%	34.2%	31.8%	28.4%	26.3%	25.3%	25.3%	25.3%	25.3%	25.3%
Real Interest Rate	31.2%	9.3%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%
Government Interest Rate	22.7%	25.5%	23.3%	20.0%	18.1%	17.2%	17.2%	17.2%	17.2%	17.2%
Stock of M1/GDP	11.6%	11.9%	11.3%	11.4%	11.4%	11.4%	11.4%	11.4%	11.4%	11.4%
Stock of Quasi-money/GDP	21.5%	21.4%	19.5%	19.5%	19.5%	19.5%	19.5%	19.5%	19.5%	19.5%
Stock of credit to private sector/GDP	34.2%	35.4%	34.9%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%	35.0%
Export Growth Rate		7.5%	-1.4%	12.7%	8.1%	6.0%	7.8%	0.7%	2.4%	1.9%
Growth rate manufacturing exports				4.2%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Exports/GDP	19.0%	17.8%	17.0%	17.6%	17.3%	17.9%	18.3%	17.5%	17.3%	17.1%
Import Growth Rate		-4.1%	4.4%	2.7%	4.6%	3.1%	3.5%	5.3%	4.4%	4.5%
Growth rate intermediate imports				3.7%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Growth rate private capital imports	-15.5%	8.4%	3.0%	3.5%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Growth rate private cons imports		5.5%	4.3%	3.1%	3.8%	3.9%	3.9%	3.9%	3.9%	3.9%
Imports/GDP	15.2%	15.5%	16.2%	16.1%	16.2%	16.0%	15.9%	16.1%	16.2%	16.3%
Current Account Deficit (in US$million)	-566	-75	353	554	656	107	-115	335	443	724
Current Account Deficit/GDP	-1.6%	-0.2%	0.9%	1.3%	1.4%	0.2%	-0.2%	0.6%	0.7%	1.0%
Net International Reserves (US$million)	3512	3484	3838	4053	4474	4868	5314	5904	6505	7172
Net Reserves (in months imports)	7.29	7.29	7.29	7.29	7.29	7.29	7.29	7.29	7.29	7.29
Total External Debt Ratio	39.4%	42.5%	39.8%	38.3%	36.7%	33.9%	31.0%	29.2%	27.6%	26.4%
Public Debt Ratio	38.6%	42.8%	40.8%	40.6%	39.5%	37.3%	34.8%	33.4%	32.1%	31.3%

TABLE 3
SIMULATION : DIFFERENCES FROM BASE CASE
FISCAL CLOSURE
EXCHANGE RATE APPRECIATION

	1990	1991	1992	1993	1994	1995
GDP Growth Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Investment Growth Rate	1.46%	1.54%	1.58%	0.85%	1.01%	0.82%
Private	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Public	5.05%	5.21%	5.75%	0.51%	2.35%	1.50%
GDP per capita Growth Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Consumption per capita growth rate	-0.09%	-0.12%	-0.11%	-0.00%	-0.02%	0.01%
Gross Investment/GDP	0.21%	0.44%	0.67%	0.80%	0.95%	1.07%
Domestic Savings/GDP	-0.01%	-0.02%	-0.04%	-0.06%	-0.08%	-0.10%
National Savings/GDP	0.03%	0.03%	0.01%	-0.04%	-0.11%	-0.20%
Marginal National Savings Rate	3.86%	3.59%	3.19%	0.12%	-0.05%	-1.27%
Private Investment/GDP	-0.05%	-0.09%	-0.14%	-0.18%	-0.23%	-0.27%
Private Consumption/GDP	0.01%	0.02%	0.04%	0.06%	0.08%	0.10%
Private Savings/GDP	0.00%	0.02%	0.03%	0.05%	0.07%	0.10%
Private Resource Balance/GDP	0.05%	0.11%	0.17%	0.23%	0.30%	0.37%
Public Investment/GDP	0.26%	0.53%	0.81%	0.99%	1.18%	1.34%
Public Savings/GDP	0.03%	0.02%	-0.02%	-0.09%	-0.19%	-0.30%
Public Revenues/GDP	-0.03%	-0.06%	-0.09%	-0.12%	-0.15%	-0.18%
Public Expenditures/GDP	0.19%	0.46%	0.73%	0.95%	1.21%	1.46%
Public Deficit/GDP	0.23%	0.52%	0.83%	1.08%	1.37%	1.64%
MLT External Financing	0.18%	0.44%	0.72%	0.93%	1.19%	1.44%
ST External Financing	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic financing-financial system	0.05%	0.08%	0.11%	0.15%	0.17%	0.21%
Domestic financing-private sector	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Residual	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Real exchange rate index	0.02	0.04	0.05	0.07	0.09	0.11
Real Exchange Rate Depreciation(-)	1.80%	1.80%	1.80%	1.80%	1.80%	1.80%
Domestic Inflation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Exchange Rate Depreciation	-2.06%	-2.04%	-2.04%	-2.04%	-2.04%	-2.04%
Nominal Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Real Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Government Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Stock of M1/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Stock of Quasi-money/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Stock of credit to private sector/GDP	-0.12%	-0.23%	-0.35%	-0.46%	-0.57%	-0.67%
Export Growth Rate	-0.39%	-0.36%	-0.34%	-0.38%	-0.36%	-0.37%
Growth rate manufacturing exports	-1.42%	-1.42%	-1.42%	-1.42%	-1.42%	-1.42%
Exports/GDP	-0.37%	-0.76%	-1.13%	-1.43%	-1.75%	-2.04%
Import Growth Rate	0.92%	0.93%	0.93%	0.89%	0.90%	0.89%
Growth rate intermediate imports	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%
Growth rate private capital imports	0.92%	0.92%	0.92%	0.92%	0.92%	0.92%
Growth rate private cons imports	1.82%	1.82%	1.82%	1.83%	1.83%	1.84%
Imports/GDP	-0.15%	-0.28%	-0.42%	-0.57%	-0.72%	-0.87%
Current Account Deficit (in US$million)	93	216	375	572	812	1110
Current Account Deficit/GDP	0.18%	0.41%	0.66%	0.85%	1.07%	1.28%
Net International Reserves (US$million)	39	87	144	211	291	384
Net Reserves (in months imports)	0.0	0.0	0.0	0.0	0.0	0.0
Total External Debt Ratio	-0.44%	-0.54%	-0.31%	0.16%	0.88%	1.80%
Public Debt Ratio	-0.32%	-0.29%	0.07%	0.68%	1.52%	2.56%

46. The real exchange rate appreciation initially improves the external debt ratio to GDP because of the valuation effect. However, as the current account deficit widens the debt ratio worsens, until by the end of the period the debt ratio is above that in the base case. The public debt ratio (including both internal and external public debt) behaves in an analogous fashion.

47. The increase in public investment occurs because the real exchange rate appreciation increases the financing available to the public sector (i.e., the simulation assumes that additional external financing is in fact available).[10] External loans to the public sector increase due to the rise in the current account deficit and higher foreign reserve accumulation. Foreign exchange reserves must rise to meet the target of a given ratio of reserves to imports. Since net disbursements to the public sector are the residual for the balance of payments, they must rise to cover both the higher current account deficit and the higher reserves. The economic reasoning is that a target of real exchange appreciation requires a higher, externally-financed public deficit to be consistent with the absorption of a higher net inflow of tradeable goods. Since public investment is the residual for the "above the line" public sector accounts, the higher fiscal deficit requires a higher level of public investment.

48. The real exchange rate appreciation also decreases public saving by the end of the period, largely because of interest costs on the higher public external debt due to larger deficits. The real exchange rate change also affects the valuation of dollar income and expenditure by the public sector,

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10/ If additional external financing is not forthcoming, then the real exchange rate must adjust endogenously instead of being targetted. This is pursued in part II of the paper.

but these effects roughly offset each other. The decline in public saving restrains slightly the increase in public investment.

49. Private saving and investment are also affected by the real exchange rate appreciation. Private saving increases slightly because of the rise in private disposable income. This in turn is due to the fall in the real value of three private expenditures that are subtracted when calculating disposable income: trade taxes on private sector imports, private external interest payments, and remittances of profits on foreign direct investment. Private investment falls as a ratio to GDP because the ratio of the investment deflator to the general GDP deflator falls due to the high import component of private investment. The real volume of private investment is unchanged because both the real interest rate and GDP growth are assumed to be unchanged in the simulation.

50. Lower private investment decreases the private sector's net requirements from the banking system, so that domestic credit to the public sector can increase. This contributes also to the increase in the financeable public sector deficit. The higher private saving also lowers the inflow of external short-term capital to the private sector, which permits higher external finance to the public sector.

51. To sum up, an accumulated real exchange rate appreciation of 11 percent over 1990-95 permits a higher public sector deficit by 1.6 percentage points of GDP by 1995.[11] Of this, 1.4 percentage points is financed from

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11/ This simulation shows how a higher fiscal deficit would lead to appreciation if we were to reverse the causality -- i.e. fix the deficit and its financing and determine the "target" variables endogenously.

external sources and .2 points from internal sources. Since public saving falls by 0.3 percentage points due to higher interest costs, public investment can only increase by 1.3 percentage points of GDP.

B. Higher Real Interest Rate

52. The next simulation involves an increase in the real interest rate by 7.3 percentage points beginning in 1990 and continuing through 1995. The government interest rate increases commensurately. Inflation and the real exchange rate are unchanged. The differences between this simulation and the base case are shown in Table 4.

53. The public deficit increases by 1.3 percentage points of GDP by 1991 and stays at about that level through 1995. The increase is mostly due to an increase in the available internal financing, with the majority of this coming from the banking system.

54. The higher real interest rate induces higher holdings of quasi-money, which causes a strong one-time portfolio shift away from foreign assets in 1990. After 1990, there is a sustained higher level of quasi-money accumulation as the private sector maintains the new higher ratio of quasi-money to GDP. The counterpart to the one-time shift to quasi-money is a private capital inflow from abroad, which represents a reduction in the net holdings of foreign assets. There is no effect on money demand, because this is assumed to be a pure transactions demand dependent only on the rate of inflation, which is supported by econometric evidence.

TABLE 4
SIMULATION : DIFFERENCES FROM BASE CASE
FISCAL CLOSURE
HIGH INTEREST RATE

	1990	1991	1992	1993	1994	1995
GDP Growth Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Investment Growth Rate	-2.53%	1.43%	-0.46%	-0.30%	-0.24%	-0.23%
Private	-3.56%	0.00%	0.00%	0.00%	0.00%	0.00%
Public	-0.01%	4.82%	-1.06%	-2.21%	-0.97%	-0.92%
GDP per capita Growth Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Consumption per capita growth rate	0.52%	-0.32%	0.09%	0.08%	0.06%	0.06%
Gross Investment/GDP	-0.48%	-0.19%	-0.27%	-0.34%	-0.39%	-0.45%
Domestic Savings/GDP	-0.40%	-0.16%	-0.23%	-0.28%	-0.33%	-0.37%
National Savings/GDP	-0.40%	-0.15%	-0.18%	-0.24%	-0.29%	-0.33%
Marginal National Savings Rate	-10.34%	17.38%	-2.39%	-3.09%	-2.76%	-2.39%
Private Investment/GDP	-0.48%	-0.48%	-0.48%	-0.48%	-0.48%	-0.48%
Private Consumption/GDP	0.40%	0.16%	0.23%	0.28%	0.33%	0.37%
Private Savings/GDP	0.07%	0.96%	0.96%	0.97%	0.98%	0.99%
Private Resource Balance/GDP	0.55%	1.44%	1.44%	1.45%	1.46%	1.47%
Public Investment/GDP	-0.00%	0.29%	0.21%	0.14%	0.09%	0.03%
Public Savings/GDP	-0.47%	-1.10%	-1.14%	-1.22%	-1.28%	-1.32%
Public Revenues/GDP	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%
Public Expenditures/GDP	0.46%	1.38%	1.34%	1.34%	1.35%	1.34%
Public Deficit/GDP	0.47%	1.39%	1.35%	1.35%	1.36%	1.36%
MLT External Financing	-4.87%	0.30%	0.22%	0.22%	0.23%	0.23%
ST External Financing	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic financing-financial system	5.15%	1.06%	1.09%	1.09%	1.09%	1.09%
Domestic financing-private sector	0.19%	0.04%	0.04%	0.04%	0.04%	0.04%
Residual	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Real exchange rate index	0.00	0.00	0.00	0.00	0.00	0.00
Real Exchange Rate Depreciation(-)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic Inflation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Exchange Rate Depreciation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nominal Interest Rate	8.99%	8.92%	8.92%	8.92%	8.92%	8.92%
Real Interest Rate	7.31%	7.31%	7.31%	7.31%	7.31%	7.31%
Government Interest Rate	8.41%	8.34%	8.34%	8.34%	8.34%	8.34%
Stock of M1/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Stock of Quasi-money/GDP	2.29%	2.29%	2.29%	2.29%	2.29%	2.29%
Stock of credit to private sector/GDP	-1.20%	-1.20%	-1.20%	-1.20%	-1.20%	-1.20%
Export Growth Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Growth rate manufacturing exports	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Exports/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Import Growth Rate	-0.55%	0.32%	-0.09%	-0.08%	-0.06%	-0.06%
Growth rate intermediate imports	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Growth rate private capital imports	-3.56%	0.00%	0.00%	0.00%	0.00%	0.00%
Growth rate private cons imports	0.59%	-0.36%	0.10%	0.09%	0.06%	0.07%
Imports/GDP	-0.08%	-0.03%	-0.05%	-0.06%	-0.07%	-0.08%
Current Account Deficit (in US$million)	-38	-22	-51	-60	-66	-84
Current Account Deficit/GDP	-0.08%	-0.04%	-0.09%	-0.10%	-0.10%	-0.12%
Net International Reserves (US$million)	-23	-10	-16	-22	-28	-34
Net Reserves (in months imports)	0.0	0.0	0.0	0.0	0.0	0.0
Total External Debt Ratio	-4.87%	-4.14%	-3.55%	-3.01%	-2.51%	-2.06%
Public Debt Ratio	0.47%	1.16%	1.76%	2.30%	2.81%	3.26%

55. The higher real interest rate also leads to a drop in private investment, which reduces the private sector demand for credit from the banking system (assumed to be proportional to investment). The combination of increased private financial saving and lower credit demand allows an expansion in credit to the public sector. The effect is very strong the first year because of the one-time portfolio shift, then the increased financing becomes more modest as financial stocks settle at their new long-run ratios to GDP. The one-time foreign capital inflow to the private sector also reduces sharply external financing to the public sector the first year. Since the capital flow to the public sector is the residual for the balance of payments, an increased capital flow to the private sector and a roughly unchanged current account deficit imply the government must reduce sharply its net external borrowing.

56. The increase in the financeable public deficit does not translate fully into an increase in public investment. The increase in the interest rate translates immediately into higher interest costs on the domestic government debt. Although there is an offsetting effect as the government external debt is reduced, the net change in total interest costs is still strongly positive because domestic interest rates are higher than foreign ones. This effect grows stronger over time as more government internal debt is accumulated through the higher deficits. Thus, the level of public investment increases only .3 percentage points of GDP in 1991, even though the deficit increases by 1.4 percentage points. By 1995, higher interest costs are absorbing all of the increased financing and the increase in public investment is practically nil. This is the outcome of an internal debt spiral since the real interest rate (10%) greatly exceeds the growth rate (4%).

57. Private saving increases as a result of the higher real interest rates. This is not because of any interest elasticity of saving. Private disposable income increases because of the higher interest earnings on holdings of government debt, which more than offset diminished earnings on net private foreign assets because of the higher domestic interest rate.

58. The current account deficit is marginally reduced because of the reduction in total investment, as the reduction in private investment more than offsets the increase in public investment. The lower investment causes lower imports of capital goods for a given real exchange rate.

59. In summary, increasing the real interest rate raises the financeable public deficit by 1.4 percentage points of GDP by 1991 due to a one-time portfolio shift. However, the high real domestic interest rate leads to a debt spiral that results in most of the new financing being used to pay the additional interest by the end of the period, rather than finding its way into increased public investment.

C. Increase in Inflation

60. Table 5 shows the effects of an increase in the inflation rate by 6 percentage points, from 22% to 28%, beginning in 1990. The real exchange rate and the real interest rate are unchanged, so that the nominal interest rate and the nominal exchange rate increase to match the higher inflation. However, the nominal government interest rate is assumed to remain unchanged.[12]

12/ As noted earlier, the fixed nominal government interest rate allows the government to use the inflation tax (as opposed to debt finance) as a means to finance the deficit.

TABLE 5
SIMULATION : DIFFERENCES FROM BASE CASE
FISCAL CLOSURE
HIGH INFLATION

	1990	1991	1992	1993	1994	1995
GDP Growth Rate	-0.00%	0.00%	0.00%	-0.00%	-0.00%	-0.00%
Investment Growth Rate	1.34%	0.34%	0.19%	0.03%	0.02%	0.02%
Private	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Public	4.65%	1.41%	0.97%	-0.92%	-0.17%	-0.19%
GDP per capita Growth Rate	-0.00%	0.00%	0.00%	-0.00%	-0.00%	-0.00%
Consumption per capita growth rate	-0.28%	-0.06%	-0.04%	-0.03%	-0.01%	-0.01%
Gross Investment/GDP	0.26%	0.32%	0.35%	0.37%	0.38%	0.39%
Domestic Savings/GDP	0.21%	0.26%	0.29%	0.31%	0.31%	0.32%
National Savings/GDP	0.21%	0.26%	0.27%	0.29%	0.29%	0.29%
Marginal National Savings Rate	5.50%	1.51%	1.16%	0.99%	0.61%	0.63%
Private Investment/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Private Consumption/GDP	-0.21%	-0.26%	-0.29%	-0.31%	-0.31%	-0.32%
Private Savings/GDP	0.17%	0.21%	0.23%	0.25%	0.26%	0.27%
Private Resource Balance/GDP	0.17%	0.21%	0.23%	0.25%	0.26%	0.27%
Public Investment/GDP	0.26%	0.32%	0.35%	0.37%	0.38%	0.39%
Public Savings/GDP	0.04%	0.04%	0.04%	0.04%	0.03%	0.02%
Public Revenues/GDP	-0.00%	-0.00%	-0.00%	-0.00%	-0.00%	-0.00%
Public Expenditures/GDP	0.22%	0.27%	0.31%	0.33%	0.35%	0.37%
Public Deficit/GDP	0.22%	0.27%	0.31%	0.34%	0.35%	0.37%
MLT External Financing	0.01%	-0.09%	-0.08%	-0.05%	-0.03%	-0.01%
ST External Financing	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic financing-financial system	0.16%	0.30%	0.32%	0.32%	0.32%	0.32%
Domestic financing-private sector	0.05%	0.06%	0.06%	0.06%	0.06%	0.06%
Residual	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Real exchange rate index	0.00	0.00	0.00	0.00	0.00	0.00
Real Exchange Rate Depreciation(-)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic Inflation	5.00%	6.00%	6.00%	6.00%	6.00%	6.00%
Exchange Rate Depreciation	4.74%	5.69%	5.69%	5.69%	5.69%	5.69%
Nominal Interest Rate	5.13%	6.16%	6.16%	6.16%	6.16%	6.16%
Real Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Government Interest Rate	-0.00%	-0.00%	-0.00%	-0.00%	-0.00%	-0.00%
Stock of M1/GDP	-0.11%	-0.13%	-0.13%	-0.13%	-0.13%	-0.13%
Stock of Quasi-money/GDP	-0.00%	0.00%	0.00%	0.00%	-0.00%	-0.00%
Stock of credit to private sector/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Export Growth Rate	0.00%	0.00%	0.00%	-0.00%	0.00%	0.00%
Growth rate manufacturing exports	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Exports/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Import Growth Rate	0.29%	0.07%	0.04%	0.02%	0.01%	0.01%
Growth rate intermediate imports	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Growth rate private capital imports	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Growth rate private cons imports	-0.32%	-0.07%	-0.04%	-0.03%	-0.01%	-0.02%
Imports/GDP	0.04%	0.06%	0.06%	0.06%	0.07%	0.07%
Current Account Deficit (in US$million)	20	30	39	49	60	72
Current Account Deficit/GDP	0.04%	0.06%	0.07%	0.08%	0.09%	0.10%
Net International Reserves (US$million)	12	17	20	24	27	30
Net Reserves (in months imports)	0.0	0.0	0.0	0.0	0.0	0.0
Total External Debt Ratio	0.01%	-0.09%	-0.16%	-0.19%	-0.20%	-0.20%
Public Debt Ratio	0.01%	0.02%	0.04%	0.07%	0.11%	0.16%

This means that the inflation tax on the public internal debt will accrue to the government, which has an important effect on the solution.

61. The simulation increases the financeable public deficit by .4 percentage points of GDP by 1995. This comes from the increased nominal money and quasi-money accumulation by the private sector to keep up with the higher inflation. There is a decline in the ratio of money balances to GDP, but this is more than offset by the increased inflation as we are still on the left-hand side of the inflation tax Laffer curve.

62. The increased public deficit translates directly into higher public investment by .4 percentage points of GDP, which actually increases slightly more than the deficit. The real domestic interest costs of the government fall, due to the lower real interest rate on government debt. Ironically, the increase in government investment is greater than in the higher real interest rate simulation, although the increase in the public deficit is much higher in the latter. Inflationary financing of a fiscal expansion is much cheaper in the short-run, although there are serious distortions caused by inflation that are not captured by this model.

63. The other significant effect of the higher inflation in the model is a drop in private consumption. The higher inflation tax reduces the effective disposable income that determines consumption. However, since measured disposable income does not include the inflation tax, the measured private saving rate increases. There is also a slight increase in the current account deficit because of higher public investment and thus higher capital goods imports.

64. In summary, higher inflation of 6 percentage points allows the fiscal deficit to be increased by .3 percentage points of GDP. This is financed through the inflation tax on private money balances, which reduces private consumption. With the current account only slightly changed, the result is a crowding out of private consumption by public investment.

D. Conclusion

65. The results of the simulations can be summarized by graphs of public investment, public savings, and financing of the public deficit, shown as ratios to GDP in Figures 1-3. Figure 4 shows a graph of the differences from the base case in the current account deficit, public resource balance, and private resource balance.

66. Figure 1a shows the external financing of the public deficit under alternative closures. Only the exchange rate appreciation scenario increases significantly the external financing, while the high interest rate scenario strongly decreases it in the first year. This latter effect is due to the one-time capital inflow to the private sector induced by the increase in the interest rate. Figure 1b shows the domestic financing of the public sector deficit. The high interest rate case represents the strongest shift towards domestic financing, above all in the first year when the private sector makes a one-time foreign portfolio shift in response to the interest rate increase. Higher inflation also raises domestic financing, while an exchange rate appreciation only has a negligible effect. Finally, Figure 1c combines the two graphs into the total financing of the public deficit. By the end of the period, a 10% cumulative real appreciation generates the strongest increase in deficit finance. A 7 percentage point rise in the domestic real interest rate

FIGURE 1A

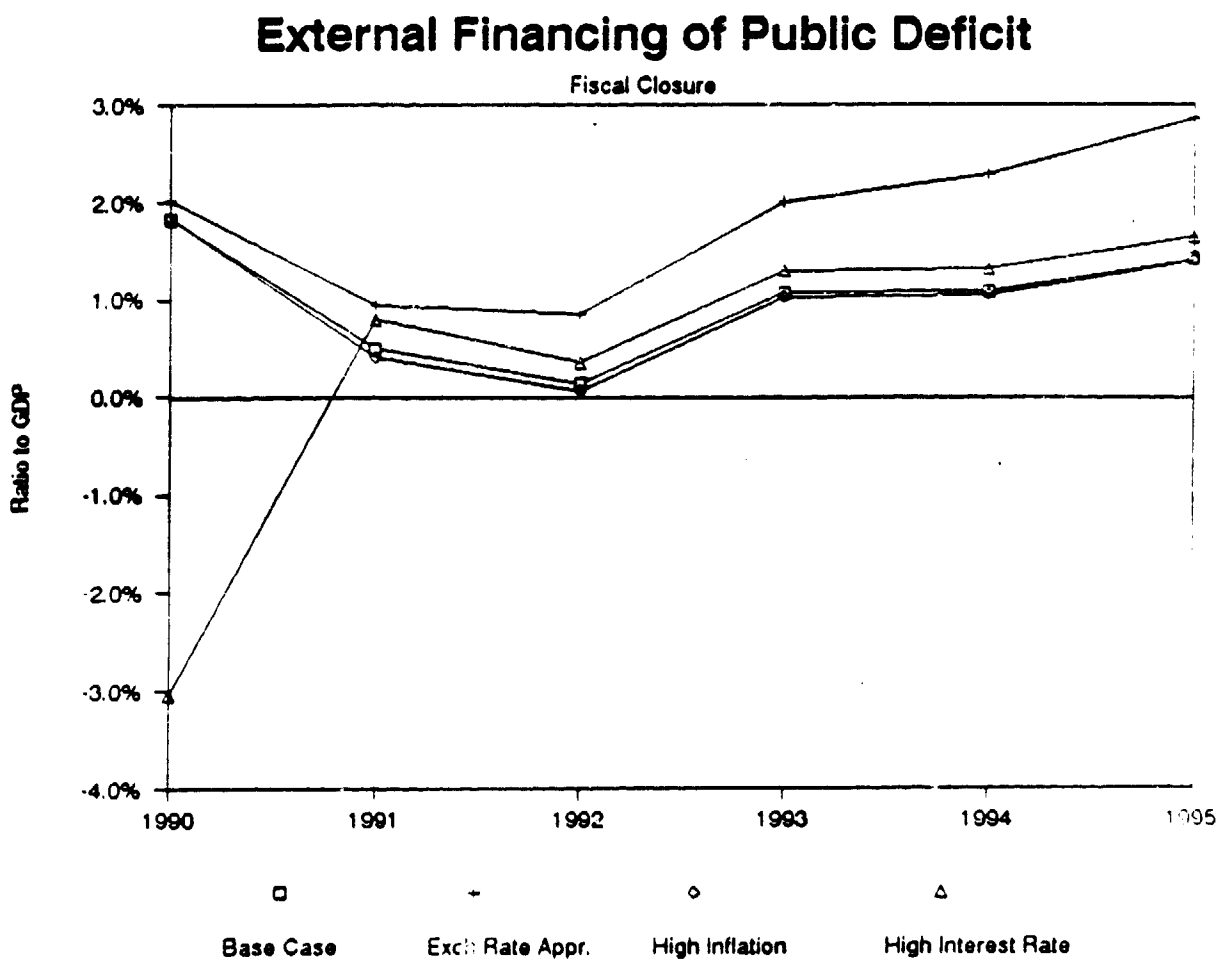

External Financing of Public Deficit
Fiscal Closure
Ratio to GDP
3.0%
2.0%
1.0%
0.0%
-1.0%
-2.0%
-3.0%
-4.0%
1990
1991
1992
1993
1994
1995
Base Case
Exch Rate Appr.
High Inflation
High Interest Rate

FIGURE 1B

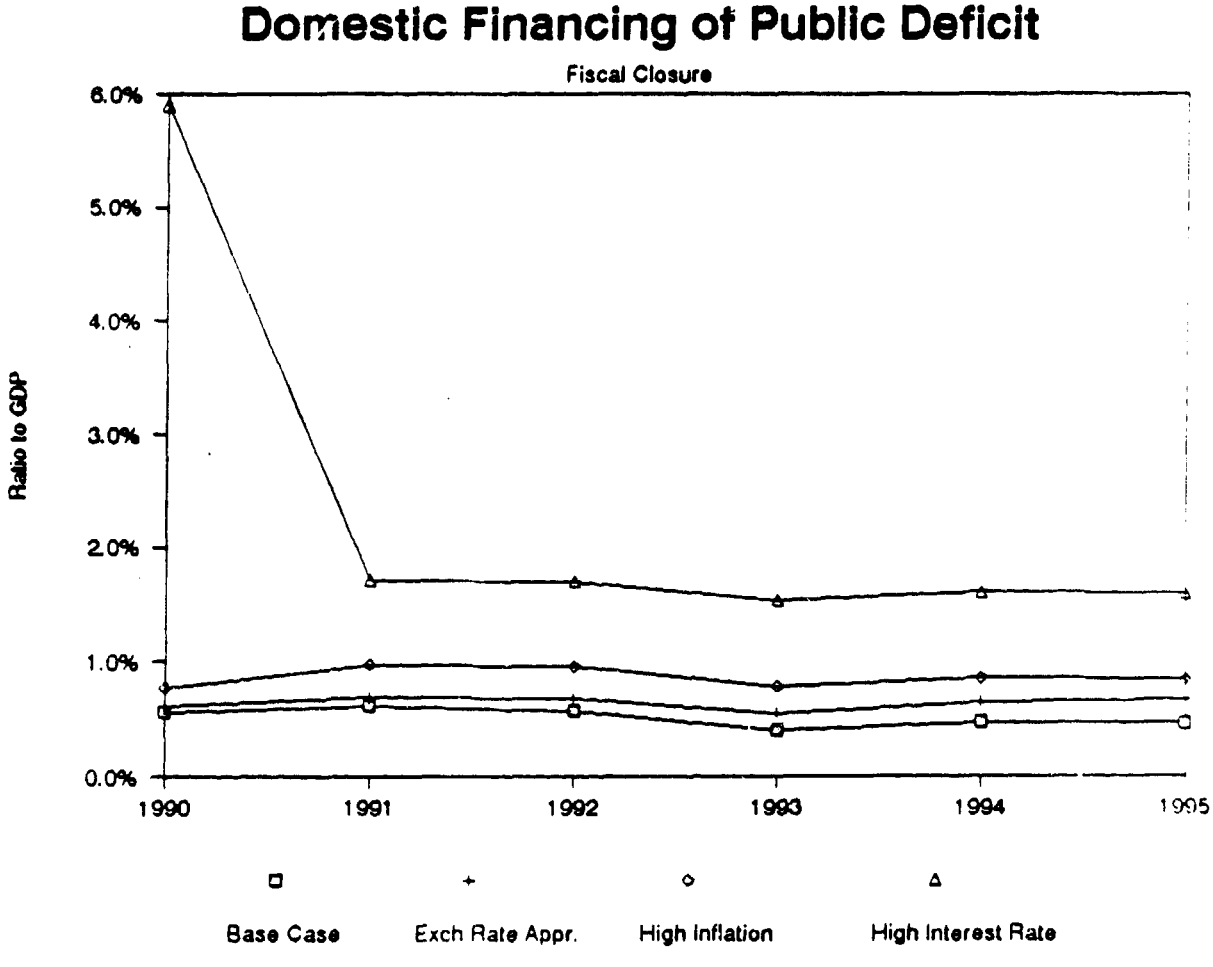
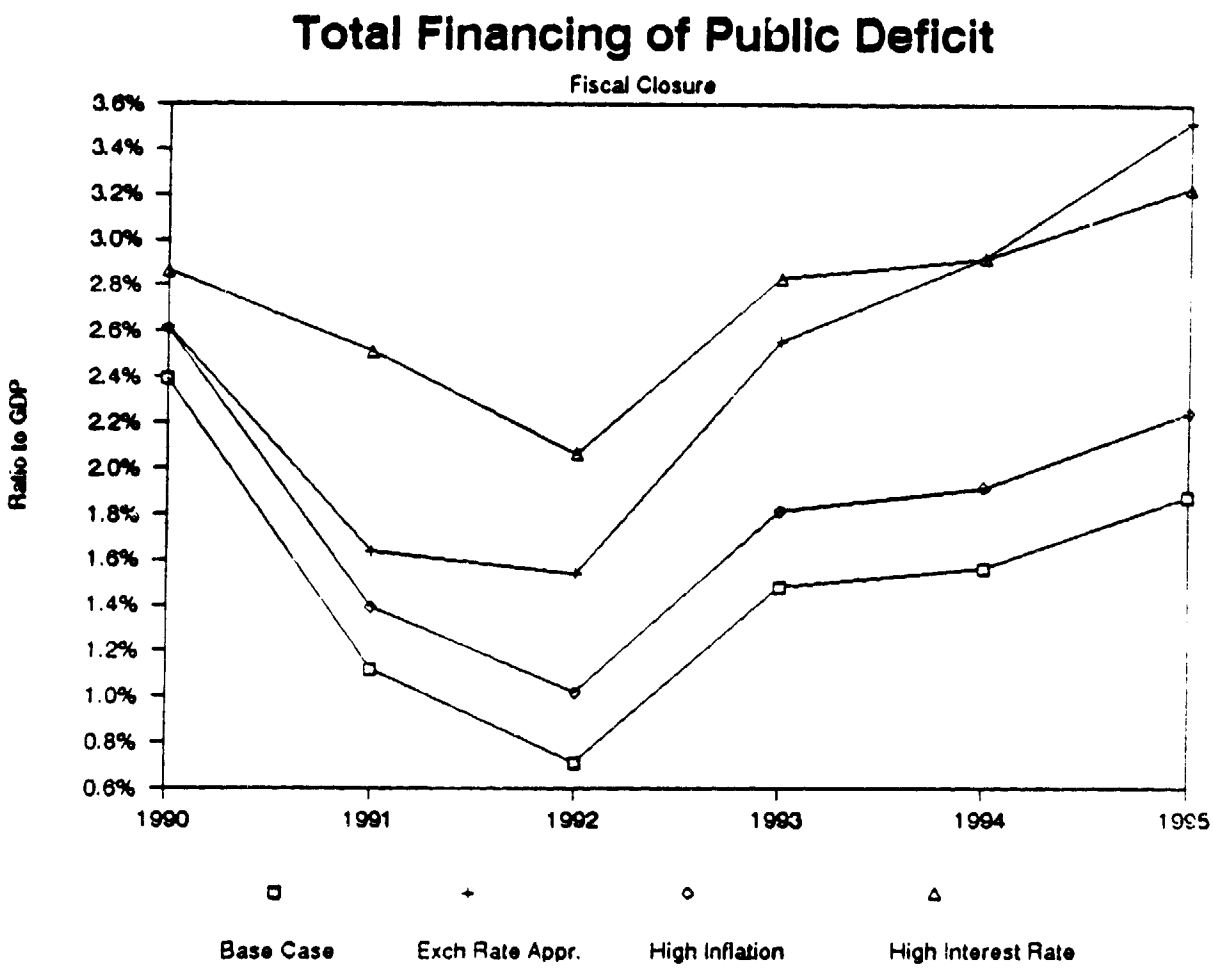

Domestic Financing of Public Deficit
Fiscal Closure
Ratio to GDP
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
1990
1991
1992
1993
1994
1995
Base Case
Exch Rate Appr.
High Inflation
High Interest Rate

FIGURE 1C


Total Financing of Public Deficit
Fiscal Closure
Ratio to GDP
3.6%
3.4%
3.2%
3.0%
2.8%
2.6%
2.4%
2.2%
2.0%
1.8%
1.6%
1.4%
1.2%
1.0%
0.8%
0.6%
1990
1991
1992
1993
1994
1995
Base Case
Exch Rate Appr.
High Inflation
High Interest Rate

has a stronger effect earlier in the period but is second by the end of the projection. A 6 percentage point increase in inflation has the weakest response in financing.

67. Figure 2 shows the effect of the alternative simulations on public saving. The strongest decline in public saving comes from increasing the domestic real interest rate, which increases total interest costs because it induces a shift to more expensive domestic public debt and away from cheaper foreign public debt as well as raising the cost of the existing domestic debt and the additional total debt accumulated. A real exchange rate appreciation lowers public saving in the outer part of the period because of the higher external debt and associated interest costs. High inflation actually improves public saving slightly because of the lower real burden of the domestic debt.

68. The final fiscal outcome of the simulations is the financeable level of public investment, shown in Figure 3. By the end of the period, public investment under the high interest rate case is scarcely different from the base case, although the increase in the financing of the deficit is greatest over the entire period in this scenario. This shows how a domestic debt spiral can wipe out any gains from increasing domestic interest rates. The increase in public investment is greatest under the real exchange rate appreciation case--although an increasing debt burden is evident there as well. A debt spiral is slower in developing because the interest rate on external debt is lower than that on domestic debt. Of course, there is no guarantee that the required amount of external financing would be forthcoming in international capital markets.[13] Finally, inflationary finance is effective

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13/ This problem is addressed in the following section.

FIGURE 2

PUBLIC SAVINGS

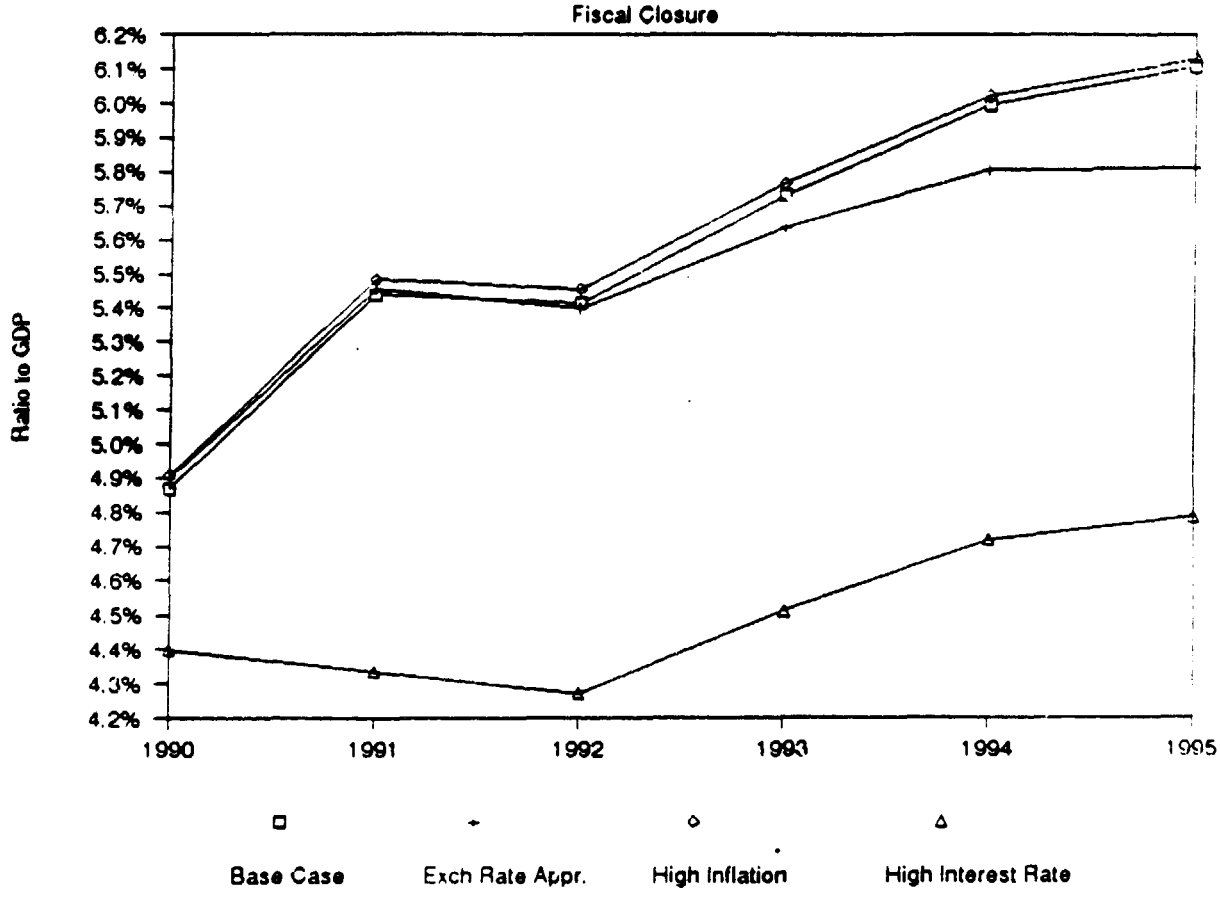
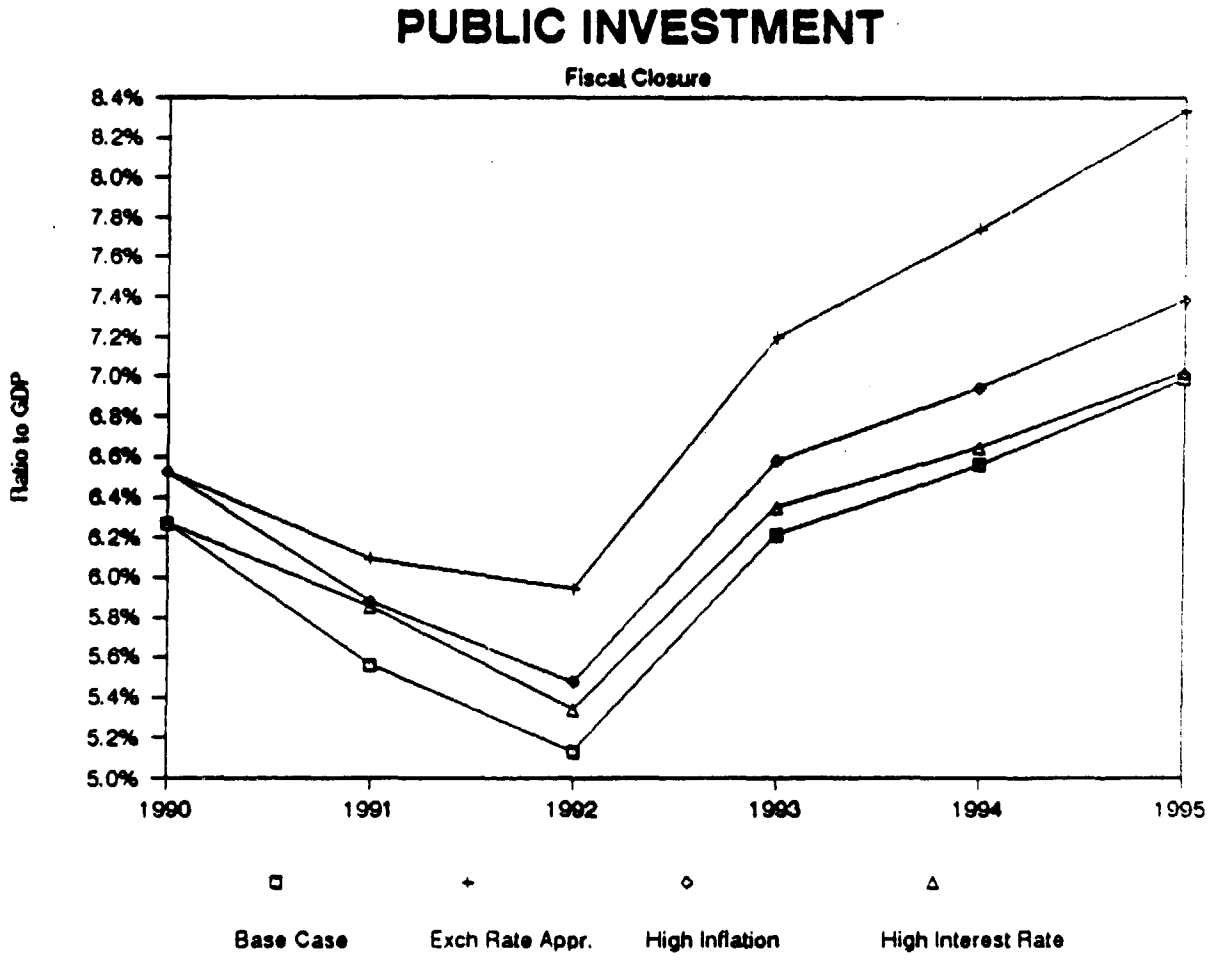


FIGURE 3


PUBLIC INVESTMENT
Fiscal Closure
Ratio to GDP
8.4%
8.2%
8.0%
7.8%
7.6%
7.4%
7.2%
7.0%
6.8%
6.6%
6.4%
6.2%
6.0%
5.8%
5.6%
5.4%
5.2%
5.0%
1990
1991
1992
1993
1994
1995
Base Case
Exch Rate Appr.
High Inflation
High Interest Rate

in increasing public investment at no cost in terms of public saving, although the effect of inflation on general economic efficiency is not being captured.

69. Figure 4 gives a summary of the model results in terms of the effect on the changes in the resource balances of the external sector, public sector, and private sector.[14] We know from the savings-investment identity that these changes must sum to zero. We can see from this the changes in the current account deficit and the private saving-investment surplus that correspond to changes in the public deficit. Under the real exchange appreciation case, the counterpart to the increased public deficit is largely a higher current account deficit. In the high real interest rate case, on the other hand, the increased public deficit results in a higher private saving-investment surplus. This is because of the crowding out of private investment and the higher private saving out of the additional interest income on government debt. The current account deficit is actually decreased because of lower imports for investment. Finally, in the high inflation case, the counterpart to the increased public deficit is both a higher current account deficit and higher private saving-investment. The former is caused by the capital goods imports required by higher public investment; the latter results from the higher nominal private saving associated with the inflation tax.

70 These solutions give insight into what would be the effects of changes in the fiscal deficit and its financing composition. An externally-financed deficit increase would lead to real appreciation; a fiscal expansion

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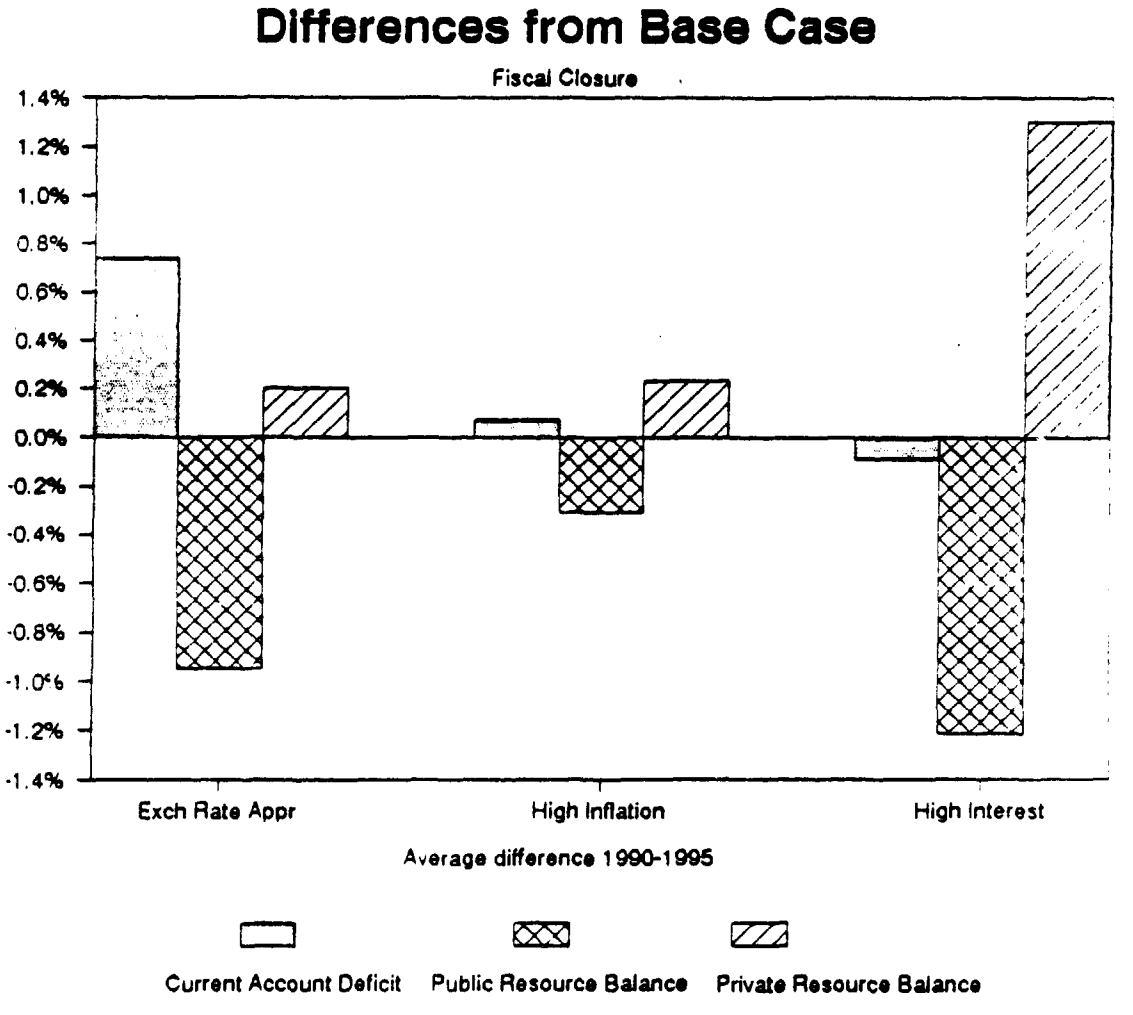
14/ The resource balance of the public sector is public saving minus investment, which is not exactly equal to the public sector surplus/deficit because the latter includes net lending by the public sector. However, net lending is assumed not to change, so that changes in the resource balance are equivalent to changes in the public surplus/deficit. The resource balance of the external sector is equivalent to the current account deficit.

FIGURE 4


Differences from Base Case
Fiscal Closure
1.4%
1.2%
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%
-0.2%
-0.4%
-0.6%
-0.8%
-1.0%
-1.2%
-1.4%
Exch Rate Appr
High Inflation
High Interest
Average difference 1990-1995
Current Account Deficit
Public Resource Balance
Private Resource Balance

financed by domestic debt would lead to an increased real interest rate; a money-financed increase in the deficit would lead to higher inflation.

PART II: EXTENSIONS OF THE MODEL

71. While the basic model presented above is useful for dramatizing the macroeconomic consistency issues, it lacks detail necessary to address several policy issues that are particularly prominent in Colombia (such as trade liberalization and improving the efficiency of the financial sector). To address these issues, we extend the model in several directions. Still using the fiscal closure as the benchmark, we consider cases in which the external financing of the public sector is constrained, with the real exchange rate adjusting. We also add detail to the model on the tax system and banking system, most notably by specifying trade taxes as affecting both price incentives and fiscal revenues, and by distinguishing between the central bank and the rest of the banking system. We then consider variations in trade and financial policy. We also modify the model to make GDP growth depend endogenously on total investment of the previous year and on a given parameter of investment efficiency, instead of fixing it as in the three sets of simulations done with the basic model. The GDP growth equation is added to dramatize the need for fiscal reform to accompany structural reform measures. For, as will be shown in the simulation discussed below, structural reforms would call for greater fiscal stringency and thus result in lower public investment and growth, unless revenues are enhanced and/or current (non-investment) expenditures are reduced. It should be noted that the model only focuses on the short-run macroeconomic implications of policy reforms. It thus ignores the possible gains in allocative efficiency and growth induced by

improved policy regimes (i.e., there is no improvement in factor productivity assumed in the model as a result of reforms; the magnitude of these effects is unknown but would presumably be substantial in the long run). Although the computational cost (in terms of staff effort) of these changes was not trivial, the extended model provides several vital insights not present in the simpler basic version.

IV. EXTERNAL FINANCING CONSTRAINT

72. The model under the fiscal closure described above has no limit on the amount of external financing from abroad. It is implicitly assumed that any fiscal or current account deficit can be financed. However, Colombia has faced severe limits on access to external borrowing like most other developing countries after the debt crisis. To take this constraint into account, the model has to be extended to include an exogenous limit on public sector external borrowing (private sector borrowing is already limited in the previous version).

73. If public sector borrowing requirement is greater than the exogenous external credit supply, then some other variable has to adjust to reconcile the behavior of the trade account with capital inflows. The obvious candidate for the adjusting variable is the real exchange rate, (and thus implicitly public spending) which was fixed as a policy target in the previous version of the model. We modify the model by adding a solution algorithm that depreciates the real exchange rate (through changes in the nominal exchange rate) whenever the requirements for foreign financing exceed the supply. The depreciation of the exchange rate will lower the current account deficit

through the response of exports and imports to the relative price change. Since public external borrowing is the residual for the balance of payments, this will also lower public borrowing, until it is consistent with foreign credit availability. As before, the fiscal deficit endogenously adjusts to be consistent with financing availability, so a real exchange rate depreciation will be supported by lower public expenditure.

74. The economic rationale for this procedure is that for given targets on inflation and the real interest rate, the fiscal deficit must decrease to be consistent with available financing. The reduction of the fiscal deficit lowers demand for domestic goods, which depreciates the equilibrium real exchange rate, which in turn makes the trade account also consistent with financing availability.

75. Tables 6 and 7 show solutions of the model with and without the real exchange rate adjustment, where Table 6 represents the new base case (different from the one presented in Table 1), calibrated more closely to the expected effects and the Government response to the drastically lower coffee prices and the war with the narcotraffickers. With a fixed target for the real exchange rate (i.e., no adjustment), the fiscal deficit increases over 1990-94, reflecting the deterioration of the external accounts due to lower coffee export prices in 1989-90 and the decline in oil export volumes after 1992. The larger current account deficit implies a larger flow of financing to the public sector, so public investment and the deficit both increase. However, when public sector financing is constrained (at numbers projected by the Banco de la República to reflect financing availability), steady real depreciation is called for over 1990-94. The constrained financing implies a

TABLE 6
MODEL SIMULATION
BASE CASE
(No Exchange Rate Adjustment)

	Historical		Estimated		Projected				
	1986	1987	1988	1989	1990	1991	1992	1993	1994
GDP Growth Rate		5.26%	3.77%	3.10%	2.60%	5.48%	5.78%	5.82%	6.18%
Investment Growth Rate		4.05%	7.76%	-4.60%	12.32%	8.51%	8.15%	9.32%	10.00%
Private		14.36%	8.22%	-9.48%	2.72%	5.54%	5.84%	6.88%	8.24%
Public		-13.60%	11.23%	8.22%	29.91%	12.81%	8.57%	13.96%	14.89%
GDP per capita Growth Rate				1.28%	0.79%	3.61%	3.91%	3.95%	4.30%
Consumption per capita growth rate				2.27%	-0.06%	3.16%	3.68%	3.96%	4.35%
Gross Investment/GDP	18.00%	19.64%	20.59%	19.21%	21.03%	21.64%	21.71%	22.43%	23.24%
Domestic Savings/GDP	21.77%	21.73%	21.37%	20.54%	21.21%	21.55%	21.73%	21.72%	21.69%
National Savings/GDP	19.62%	19.60%	19.53%	18.51%	18.08%	18.40%	18.35%	18.39%	18.37%
Marginal National Savings Rate	21.72%	-60.88%	11.92%	-12.49%	-34.41%	14.50%	9.00%	11.79%	13.71%
Private Investment/GDP	11.34%	13.53%	14.06%	12.43%	12.45%	12.45%	12.46%	12.47%	12.48%
Private Consumption/GDP	69.01%	69.44%	69.85%	70.18%	69.66%	69.32%	69.14%	69.15%	69.19%
Private Savings/GDP	12.06%	14.21%	14.12%	12.74%	12.35%	12.21%	11.98%	11.83%	11.72%
Private Resource Balance/GDP	0.72%	0.68%	0.06%	0.31%	-0.09%	-0.25%	-0.48%	-0.63%	-0.75%
Public Investment/GDP	6.66%	6.01%	6.53%	6.78%	8.59%	9.18%	9.26%	9.96%	10.76%
Public Savings/GDP	7.56%	5.39%	5.41%	5.78%	5.73%	6.19%	6.37%	6.56%	6.65%
Public Revenues/GDP	24.88%	22.67%	22.40%	22.40%	21.89%	22.15%	22.23%	22.30%	22.32%
Public Expenditures/GDP	25.00%	24.49%	24.51%	24.73%	26.08%	26.47%	26.44%	27.03%	27.76%
Public Deficit/GDP	0.32%	1.82%	2.11%	2.33%	4.18%	4.32%	4.21%	4.73%	5.44%
MLT External Financing	4.80%	-0.19%	1.18%	0.85%	3.31%	3.92%	4.00%	4.40%	5.23%
(External Financing availability)	4.60%	-0.19%	1.18%	0.85%	1.10%	0.96%	0.66%	0.55%	0.56%
ST External Financing	-2.40%	-0.36%	0.21%	0.03%	-0.20%	0.06%	-0.14%	0.05%	0.04%
Domestic financing-financial system	-2.63%	2.07%	1.26%	1.10%	0.82%	0.08%	0.10%	0.03%	-0.08%
From Banco de la Republica	-2.49%	1.72%	0.27%	0.86%	0.81%	0.31%	0.53%	0.59%	0.58%
From Rest of Financial System	-0.13%	0.35%	0.99%	0.24%	0.01%	-0.22%	-0.43%	-0.56%	-0.67%
Domestic financing-private sector	-0.01%	0.42%	0.09%	-0.09%	0.26%	0.26%	0.25%	0.25%	0.25%
Residual	0.85%	-0.12%	-0.62%	0.44%	0.00%	0.00%	0.00%	0.00%	0.00%
Real exchange rate index			100.00	95.68	95.68	95.68	95.68	95.68	95.68
Real Exchange Rate Depreciation(-)				-4.32%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic Inflation		22.87%	28.37%	27.00%	25.00%	24.00%	23.00%	22.00%	21.00%
Exchange Rate Depreciation		24.89%	23.31%	29.36%	19.50%	18.55%	17.69%	16.83%	16.68%
Nominal Interest Rate	30.90%	31.22%	34.13%	33.00%	30.91%	29.86%	28.81%	27.76%	26.72%
Real Interest Rate		6.80%	4.48%	4.72%	4.72%	4.72%	4.72%	4.72%	4.72%
Loan Rate	41.10%	39.00%	42.96%	43.40%	40.80%	39.50%	38.20%	36.90%	35.60%
Real Loan Rate		13.13%	11.37%	12.91%	12.64%	12.50%	12.36%	12.21%	12.07%
Government Interest Rate	30.90%	31.22%	34.13%	33.00%	30.91%	29.86%	28.81%	27.76%	26.72%
Rate on Forced Investment				20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
Forced Investment Ratio	7.86%	7.86%	7.86%	7.86%	7.86%	7.86%	7.86%	7.86%	7.86%
Reserve ratio	11.60%	11.60%	11.60%	11.60%	11.60%	11.60%	11.60%	11.60%	11.60%
Stock of M1/GDP	11.62%	11.94%	11.27%	10.89%	10.93%	10.95%	10.97%	10.99%	11.01%
Stock of Quasi-money/GDP	21.52%	21.42%	19.51%	19.50%	19.63%	19.39%	19.20%	19.12%	19.08%
Stock of credit to private sector/GDP	34.18%	36.35%	34.92%	35.04%	35.33%	35.04%	34.96%	35.11%	35.36%
Export Growth Rate		7.50%	-0.38%	6.42%	9.16%	6.08%	8.27%	3.90%	3.04%
Growth rate manufacturing exports	-5.00%	5.07%	4.95%	5.87%	2.60%	5.48%	5.78%	5.82%	6.18%
Exports/GDP	19.01%	17.74%	17.17%	18.41%	17.62%	17.48%	17.59%	17.01%	16.34%
Import Growth Rate		-3.69%	5.45%	3.55%	4.80%	6.20%	5.85%	6.72%	7.19%
Growth rate intermediate imports	-5.00%	5.07%	16.10%	5.06%	2.60%	5.48%	5.78%	5.82%	6.18%
Growth rate private capital imports		14.36%	8.22%	-9.70%	2.72%	5.54%	5.84%	5.88%	6.24%
Growth rate private cons imports		5.58%	4.43%	2.82%	1.85%	4.96%	5.51%	5.82%	6.24%
Tax Rate on Imports			24.28%	22.24%	22.24%	22.24%	22.24%	22.24%	22.24%
Imports/GDP	15.24%	15.55%	16.39%	17.07%	17.44%	17.56%	17.57%	17.72%	17.89%
Current Account Deficit (in US$mill)	-565.20	-21.40	414.60	275.69	1252.74	1617.80	1743.16	2318.80	3100.47
Current Account Deficit/GDP	-1.82%	-0.06%	1.06%	0.70%	2.96%	3.24%	3.36%	4.04%	4.87%
Net International Reserves (US$mill)	3477.70	3455.50	3799.50	3869.50	3922.00	4368.98	4838.81	5420.61	6101.17
Net Reserves (in months imports)	12.24	10.93	10.10	9.82	9.00	9.00	9.00	9.00	9.00
Total External Debt Ratio	39.41%	42.49%	38.90%	39.51%	40.77%	41.30%	41.53%	42.14%	43.42%
Public Debt Ratio	38.62%	42.84%	40.76%	41.22%	41.76%	41.39%	41.01%	41.30%	42.23%

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TABLE 7
MODEL SIMULATION
BASE CASE
(With Exchange Rate Adjustment)

	Historical		Estimated	Projected				
	1986	1987	1988	1989	1990	1991	1992	1993	1994
GDP Growth Rate		5.26%	3.77%	3.10%	2.50%	4.57%	4.35%	4.14%	4.33%
Investment Growth Rate		4.05%	7.76%	-4.50%	2.53%	2.16%	1.97%	5.26%	5.67%
Private		14.35%	6.22%	-9.48%	2.72%	4.64%	4.42%	4.20%	4.39%
Public		-13.50%	11.23%	6.22%	2.47%	-2.38%	-2.34%	10.61%	8.23%
GDP per capita Growth Rate				1.28%	0.79%	2.73%	2.51%	2.30%	2.48%
Consumption per capita growth rate				2.27%	-0.25%	1.92%	2.10%	2.26%	2.48%
Gross Investment/GDP	18.00%	19.54%	20.59%	19.21%	19.56%	19.31%	18.93%	19.36%	19.68%
Domestic Savings/GDP	21.77%	21.73%	21.37%	20.54%	21.24%	21.79%	22.08%	22.10%	22.07%
National Savings/GDP	19.62%	19.60%	19.53%	18.51%	17.84%	18.30%	18.46%	18.69%	18.87%
Marginal National Savings Rate	21.72%	-60.88%	11.92%	-12.49%	-44.83%	16.25%	10.39%	13.80%	16.19%
Private Investment/GDP	11.34%	13.53%	14.06%	12.43%	12.67%	12.81%	12.86%	12.89%	12.95
Private Consumption/GDP	69.01%	69.44%	69.85%	70.18%	69.63%	69.08%	68.79%	68.77%	68.80
Private Savings/GDP	12.06%	14.21%	14.12%	12.74%	12.27%	12.16%	11.91%	11.72%	11.54
Private Resource Balance/GDP	0.72%	0.68%	0.06%	0.31%	-0.40%	-0.65%	-0.95%	-1.17%	-1.41
Public Investment/GDP	6.66%	6.01%	6.53%	6.78%	6.89%	6.50%	6.07%	6.46%	6.73
Public Savings/GDP	7.56%	5.39%	5.41%	5.78%	5.57%	6.14%	6.54%	6.98%	7.33
Public Revenues/GDP	24.68%	22.67%	22.40%	22.40%	21.99%	22.31%	22.41%	22.48%	22.52
Public Expenditures/GDP	25.00%	24.49%	24.51%	24.73%	24.64%	24.00%	23.27%	23.29%	23.25
Public Deficit/GDP	0.32%	1.82%	2.11%	2.33%	2.66%	1.69%	0.86%	0.82%	0.73%
MLT External Financing	4.50%	-0.19%	1.18%	0.85%	1.19%	1.10%	0.78%	0.67%	0.70
(External Financing availability)	4.50%	-0.19%	1.18%	0.85%	1.19%	1.10%	0.78%	0.67%	0.70
ST External Financing	-2.40%	-0.36%	0.21%	0.03%	-0.22%	0.07%	-0.17%	0.06%	0.05%
Domestic financing-financial system	-2.63%	2.07%	1.26%	1.10%	1.42%	0.27%	0.00%	-0.16%	-0.27%
From Banco de la Republica	-2.49%	1.72%	0.27%	0.86%	1.53%	0.73%	0.74%	0.75%	0.83
From Rest of Financial System	-0.13%	0.35%	0.99%	0.24%	-0.12%	-0.46%	-0.74%	-0.91%	-1.09
Domestic financing-private sector	-0.01%	0.42%	0.09%	-0.09%	0.26%	0.26%	0.25%	0.25%	0.24
Residual	0.85%	-0.12%	-0.62%	0.44%	0.00%	0.00%	0.00%	0.00%	0.00
Real exchange rate index			100.00	96.68	88.02	83.90	82.63	81.96	80.55
Real Exchange Rate Depreciation(-)				-4.32%	-8.00%	-4.69%	-1.50%	-0.82%	-1.72
Domestic Inflation		22.87%	28.37%	27.00%	25.00%	24.00%	23.00%	22.00%	21.00
Exchange Rate Depreciation		24.89%	23.31%	29.36%	29.90%	24.38%	19.39%	17.60%	17.70
Nominal Interest Rate	30.90%	31.22%	34.13%	33.00%	30.91%	29.86%	28.81%	27.76%	26.72
Real Interest Rate		6.80%	4.48%	4.72%	4.72%	4.72%	4.72%	4.72%	4.72
Loan Rate	41.10%	39.00%	42.96%	43.40%	40.80%	39.50%	38.20%	36.90%	35.60
Real Loan Rate		13.13%	11.37%	12.91%	12.64%	12.50%	12.36%	12.21%	12.07
Government Interest Rate	30.90%	31.22%	34.13%	33.00%	30.91%	29.86%	28.81%	27.76%	26.72
Rate on Forced Investment				20.00%	20.00%	20.00%	20.00%	20.00%	20.00
Forced Investment Ratio	7.86%	7.86%	7.86%	7.86%	7.86%	7.86%	7.86%	7.86%	7.86
Reserve ratio	11.60%	11.60%	11.60%	11.60%	11.60%	11.60%	11.60%	11.60%	11.60
Stock of M1/GDP	11.62%	11.94%	11.27%	10.89%	10.93%	10.95%	10.97%	10.99%	11.01
Stock of Quasi-money/GDP	21.52%	21.42%	19.51%	19.50%	19.60%	19.48%	19.45%	19.51%	19.60
Stock of credit to private sector/GDP	34.18%	35.35%	34.92%	35.04%	35.47%	35.60%	36.01%	36.64%	37.35
Export Growth Rate		7.50%	-0.38%	8.42%	11.93%	7.40%	8.27%	3.73%	3.15
Growth rate manufacturing exports	-5.00%	5.07%	4.96%	5.33%	11.21%	9.62%	5.97%	5.02%	6.10
Exports/GDP	19.01%	17.74%	17.17%	18.41%	19.64%	20.87%	21.61%	21.39%	21.2
Import Growth Rate		-3.69%	5.45%	3.55%	-0.72%	2.10%	3.21%	4.27%	3.95%
Growth rate intermediate imports	-5.00%	5.07%	16.10%	6.33%	-1.99%	1.89%	3.49%	3.67%	3.3
Growth rate private capital imports		14.35%	6.22%	-9.48%	-0.76%	2.60%	3.76%	3.85%	3.6
Growth rate private cons imports		6.58%	4.43%	3.10%	-2.77%	1.06%	3.05%	3.64%	3.3
Tax Rate on Imports			24.28%	22.24%	22.24%	22.24%	22.24%	22.24%	22.2
Imports/GDP	15.24%	15.55%	16.39%	17.07%	17.96%	18.39%	18.47%	18.66%	18.8
Current Account Deficit (in US$mill)	-565.20	-21.40	414.60	275.69	672.11	411.49	211.68	313.41	415.1
Current Account Deficit/GDP	-1.62%	-0.06%	1.06%	0.70%	1.72%	1.01%	0.48%	0.66%	0.8
Net International Reserves (US$mill)	3477.70	3455.50	3799.50	3869.50	3629.17	3833.81	4117.56	4493.66	4877.56
Net Reserves (in months imports)	12.24	10.93	10.10	9.82	9.00	9.00	9.00	9.00	9.00
Total External Debt Ratio	39.41%	42.49%	38.90%	39.61%	41.91%	41.80%	39.89%	37.86%	36.3
Public Debt Ratio	38.62%	42.84%	40.76%	41.22%	43.10%	41.91%	39.07%	36.38%	34.1

capacity from the previous year's investment. In the constrained external fall in both the fiscal deficit and current account deficit, with public investment the main adjusting variable.

76. The growth rate is set exogenously in 1990 to reflect short-term projections. Beginning in 1991, the growth rate is given by the expansion in financing case, the growth rate falls slightly after 1991, reflecting the fall in public investment required by consistency with available foreign financing. In the model, lower growth lowers the financing availability to the public sector, since domestic financial assets and thus domestic loans to the public sector do not grow as fast. In contrast, growth rises in the unconstrained financing case because of higher public investment, which also increases the financeable public deficit. However, the faster growth is not enough to keep up with the increase in external debt, so that the external debt ratio rises in the unconstrained financing case. It seems clear that this scenario is not feasible either from the standpoint of the long-run budget constraint or the short-term restrictions on external credit supply.

V. MACRO REQUIREMENTS OF POLICY REFORMS

77. The model with external financing constraint can be used to address a central policy issue in Colombia--what macro policies should accompany trade liberalization, either through relaxation of quantitative restrictions or lowering of tariffs. It can also consider the macro requirements of financial liberalization and reduction of inflation.

A. Policy Simulation I: Lowering Import Tariffs

78. Reduction of tariffs will have two important eff s in the model. It will decrease the relative price of imported goods, increasing the quantity demanded for a given real exchange rate. At the same time, it lowers public revenue from taxation of trade,[15] requiring an offsetting fiscal adjustment for a given amount of financing. Of course, trade liberalization brings important efficiency gains that are not captured by our model, as well as improving export incentives by lowering the cost of inputs. The focus of the model is instead on the short-run and especially on the exchange rate depreciation and fiscal adjustment that is required by trade liberalization.

79. Table 8 shows the results of a simulation of a reduction of 4 percentage points in the tarifx in both 1990 and 1991 (for a total of 8 percentage points over a two-year period), compared with the Base Case (Table 7, Base Case with Exchange Rate Adjustment). If no other fiscal adjustment occurs, the loss of revenues would require a reduction in public investment, which would lower the growth rate by almost half a percentage point by the end of the period.[16] The lower growth rate in turn requires additional fiscal austerity, since lower growth implies domestic credit will not grow as fast. This lower growth is not a necessary consequence of tariff reduction-- it

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15/ Unless the elasticity of imports is high enough to increase the tax base enough to offset the decline in the rate, which it is not in our simulation.

16/ This presumes that public and private investment are equally productive. If public investment is less productive the growth effect will be less than that indicated.

TABLE 8
SIMULATION: DIFFERENCES FROM BASE CASE
FISCAL CLOSURE
TRADE TAXES CASE
(With Exchange Rate Adjustment)

	Projected				
	1990	1991	1992	1993	1994
GDP Growth Rate	0.00%	-0.22%	-0.45%	-0.44%	-0.43%
Investment Growth Rate	-2.33%	-2.84%	-0.47%	-0.24%	-0.31%
Private	0.00%	-0.22%	-0.45%	-0.44%	-0.43%
Public	-6.59%	-8.31%	-1.32%	1.03%	0.39%
GDP per capita Growth Rate	0.00%	-0.21%	-0.44%	-0.43%	-0.42%
Consumption per capita growth rate	0.37%	0.22%	-0.42%	-0.42%	-0.41%
Gross Investment/GDP	-0.38%	-0.81%	-0.82%	-0.82%	-0.82%
Domestic Savings/GDP	-0.32%	-0.67%	-0.68%	-0.68%	-0.69%
National Savings/GDP	-0.37%	-0.77%	-0.78%	-0.77%	-0.77%
Marginal National Savings Rate	-14.55%	-10.06%	-1.83%	-1.40%	-1.13%
Private Investment/GDP	0.04%	0.08%	0.07%	0.06%	0.06%
Private Consumption/GDP	0.32%	0.67%	0.68%	0.68%	0.69%
Private Savings/GDP	0.06%	0.11%	0.11%	0.12%	0.13%
Private Resource Balance/GDP	0.01%	0.03%	0.06%	0.06%	0.06%
Public Investment/GDP	-0.42%	-0.89%	-0.89%	-0.87%	-0.87%
Public Savings/GDP	-0.42%	-0.88%	-0.89%	-0.89%	-0.90%
Public Revenues/GDP	-0.37%	-0.79%	-0.80%	-0.80%	-0.81%
Public Expenditures/GDP	-0.37%	-0.80%	-0.80%	-0.79%	-0.78%
Public Deficit/GDP	-0.00%	-0.01%	0.00%	0.02%	0.03%
MLT External Financing	0.07%	0.03%	0.02%	0.02%	0.02%
(External Financing availability)	0.02%	0.03%	0.02%	0.02%	0.02%
ST External Financing	-0.00%	0.00%	-0.00%	0.00%	0.00%
Domestic financing-financial system	-0.02%	-0.06%	-0.02%	-0.01%	0.01%
From Banco de la Republica	-0.02%	-0.06%	-0.01%	-0.01%	-0.00%
From Rest of Financial System	0.01%	0.00%	-0.01%	0.00%	0.01%
Domestic financing-private sector	0.00%	0.00%	0.00%	0.00%	0.00%
Residual	0.00%	0.00%	0.00%	0.00%	0.00%
Real exchange rate index	-1.32	-2.19	-1.79	-1.51	-1.22
Real Exchange Rate Depreciation(-)	-1.38%	-1.08%	0.45%	0.34%	0.32%
Domestic Inflation	0.00%	0.00%	0.00%	0.00%	0.00%
Exchange Rate Depreciation	1.98%	1.42%	-0.54%	-0.40%	-0.38%
Nominal Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Real Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Loan Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Real Loan Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Government Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Rate on Forced Investment	0.00%	0.00%	0.00%	0.00%	0.00%
Forced Investment Ratio	0.00%	0.00%	0.00%	0.00%	0.00%
Reserve ratio	0.00%	0.00%	0.00%	0.00%	0.00%
Stock of M1/GDP	-0.00%	-0.00%	0.00%	0.00%	0.00%
Stock of Quasi-money/GDP	0.02%	0.08%	0.17%	0.24%	0.30%
Stock of credit to private sector/GDP	0.03%	0.13%	0.26%	0.36%	0.43%
Export Growth Rate	0.48%	0.32%	-0.32%	-0.26%	-0.26%
Growth rate manufacturing exports	1.49%	0.94%	-0.93%	-0.80%	-0.77%
Exports/GDP	0.39%	0.76%	0.71%	0.67%	0.64%
Import Growth Rate	0.27%	0.18%	-0.24%	-0.30%	-0.30%
Growth rate intermediate imports	1.50%	1.46%	-0.19%	-0.25%	-0.25%
Growth rate private capital imports	1.14%	1.06%	-0.25%	-0.29%	-0.29%
Growth rate private cons imports	1.87%	1.89%	-0.17%	-0.24%	-0.24%
Tax Rate on Imports	-4.00%	-8.00%	-8.00%	-8.00%	-8.00%
Imports/GDP	0.32%	0.62%	0.57%	0.54%	0.51%
Current Account Deficit (in US$mill)	-13.89	-28.92	-25.48	-29.26	-35.08
Current Account Deficit/GDP	-0.01%	-0.04%	-0.05%	-0.04%	-0.06%
Net International Reserves (US$mill)	14.24	28.78	25.51	17.74	8.23
Net Reserves (in months imports)	0.00	0.00	0.00	0.00	0.00
Total External Debt Ratio	0.64%	1.21%	1.15%	1.12%	1.11%
Public Debt Ratio	0.55%	1.02%	0.96%	0.96%	0.97%

occurs only because the locus of the fiscal adjustment is public investment. If other tax revenues were substituted for trade tariffs, then the fall in public investment and growth would not take place. This suggests the importance of a more general tax reform to accompany the reduction of tariff rates. In any case, empirical studies suggest that greater openness is associated with about one and a half percentage points higher growth.[17] While it is difficult to calibrate the effect of the reform considered here, it seems likely that the net growth effect would be positive even without fiscal reform.

80. The lowering of tariffs also requires additional real depreciation beyond that in the base case--slightly over 1 more percentage point each in 1990 and 1991. In 1992-94, however, there is slightly less real depreciation than in the base case. The cumulative additional real depreciation is only 1.3 percent, lower than the reduction of tariff rates of 8 percentage points. The reason is that the contraction of public investment because of lower tariff revenues itself lowers imports while the devaluation also raises exports, so that the stimulative effect on imports from lower tariff rates does not have to be fully offset by currency depreciation.

81. The policy does have the desired effect of raising the share of tradeable goods in GDP--the import and export shares are each higher by over half of one percentage point of GDP. The export share rises because of the additional real currency depreciation. The economic intuition is that tariff protection in the past led to an overvalued exchange rate that repressed

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17/ Easterly and Wetzel (1989) show that a dummy variable measuring outward orientation is associated with higher growth of one and a half percentage points across countries.

export potential. Lowering tariffs induces real depreciation back towards the long run equilibrium rate, raising the share of exports and imports in GDP. Greater outward orientation should bring higher productivity growth in the tradeable goods sector as a result of increased competition and lower import costs, resulting in higher GDP growth. But this effect is not estimated by the model.

B. Policy Simulation II: Relaxing Import Quotas

82. The other trade policy shift we consider is a relaxation of import quotas. To avoid complicating the model further, we have to address this policy shift in a roundabout fashion. Quotas lead to a premium on the imported goods whose quantities are limited. Thus, they can be treated as equivalent to a tariff, but without the revenue implications of tariff rate changes. The relaxation of the quota is simulated by specifying a reduction in the quota premium, which lowers the price of imports relative to that of domestic substitutes.

83. The results of a policy simulation of lowering the quota premium by 4 percentage points each in 1990 and 1991 (for a total of 8 percentage points) is shown in Table 9. The relaxation of the quota induces an additional real depreciation of about 1.5% per year in 1990-91. The exchange rate depreciation does not need to be as great as the quota premium reduction, because exchange rate changes also bring forth an export response. Thus, both export and import shares expand by almost 1 percentage point of GDP.

84. The effect of the additional exchange rate devaluation on public sector financing is small but complicated. The expansion in imports requires

TABLE 9
SIMULATION: DIFFERENCES FROM BASE CASE
FISCAL CLOSURE
QUOTA CASE
(With Exchange Rate Adjustment)

	Projected				
	1990	1991	1992	1993	1994
GDP Growth Rate	0.00%	-0.05%	-0.10%	-0.07%	-0.05%
Investment Growth Rate	-0.58%	-0.54%	0.19%	0.13%	0.05%
Private	0.00%	-0.05%	-0.10%	-0.07%	-0.05%
Public	-1.64%	-1.52%	0.63%	0.66%	0.30%
GDP per capita Growth Rate	0.00%	-0.05%	-0.10%	-0.07%	-0.05%
Consumption per capita growth rate	-0.05%	-0.10%	-0.08%	-0.07%	-0.06%
Gross Investment/GDP	-0.03%	-0.06%	-0.02%	0.01%	0.03%
Domestic Savings/GDP	0.01%	0.02%	0.01%	0.02%	0.02%
National Savings/GDP	-0.06%	-0.10%	-0.10%	-0.10%	-0.09%
Marginal National Savings Rate	-2.12%	-1.18%	-0.09%	0.10%	0.19%
Private Investment/GDP	0.06%	0.09%	0.08%	0.08%	0.06%
Private Consumption/GDP	-0.01%	-0.02%	-0.01%	-0.02%	-0.02%
Private Savings/GDP	-0.07%	-0.16%	-0.19%	-0.21%	-0.23%
Private Resource Balance/GDP	-0.12%	-0.26%	-0.28%	-0.30%	-0.31%
Public Investment/GDP	-0.08%	-0.15%	-0.10%	-0.07%	-0.05%
Public Savings/GDP	0.02%	0.06%	0.09%	0.12%	0.14%
Public Revenues/GDP	0.08%	0.15%	0.15%	0.14%	0.15%
Public Expenditures/GDP	-0.02%	-0.06%	-0.05%	-0.04%	-0.05%
Public Deficit/GDP	-0.10%	-0.21%	-0.20%	-0.19%	-0.19%
MLT External Financing	0.02%	0.04%	0.02%	0.02%	0.02%
(External Financing availability)	0.02%	0.04%	0.02%	0.02%	0.02%
ST External Financing	-0.00%	0.00%	-0.01%	0.00%	0.00%
Domestic financing-financial system	-0.12%	-0.25%	-0.21%	-0.21%	-0.21%
From Banco de la Republica	-0.06%	-0.13%	-0.07%	-0.06%	-0.06%
From Rest of Financial System	-0.06%	-0.12%	-0.13%	-0.14%	-0.15%
Domestic financing-private sector	-0.00%	-0.00%	-0.00%	-0.00%	-0.00%
Residual	0.00%	0.00%	0.00%	0.00%	0.00%
Real exchange rate index	-1.59	-2.87	-2.32	-2.21	-2.13
Real Exchange Rate Depreciation(-)	-1.66%	-1.34%	0.38%	0.12%	0.06%
Domestic Inflation	0.00%	0.00%	0.00%	0.00%	0.00%
Exchange Rate Depreciation	2.38%	1.77%	-0.45%	-0.14%	-0.06%
Nominal Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Real Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Loan Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Real Loan Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Government Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Rate on Forced Investment	0.00%	0.00%	0.00%	0.00%	0.00%
Forced Investment Ratio	0.00%	0.00%	0.00%	0.00%	0.00%
Reserve ratio	0.00%	0.00%	0.00%	0.00%	0.00%
Stock of M1/GDP	-0.00%	-0.00%	0.00%	0.00%	0.00%
Stock of Quasi-money/GDP	-0.02%	-0.07%	-0.11%	-0.15%	-0.19%
Stock of credit to private sector/GDP	0.03%	0.10%	0.16%	0.19%	0.22%
Export Growth Rate	0.57%	0.46%	-0.18%	-0.05%	-0.01%
Growth rate manufacturing exports	1.78%	1.39%	-0.50%	-0.19%	-0.11%
Exports/GDP	0.46%	0.90%	0.83%	0.80%	0.79%
Import Growth Rate	0.50%	0.62%	0.13%	-0.00%	-0.03%
Growth rate intermediate imports	1.34%	1.47%	0.12%	-0.00%	-0.03%
Growth rate private capital imports	1.02%	1.10%	0.07%	-0.02%	-0.03%
Growth rate private cons imports	1.23%	1.36%	0.12%	-0.01%	-0.04%
Tax Rate on Imports	0.00%	0.00%	0.00%	0.00%	0.00%
Imports/GDP	0.42%	0.82%	0.80%	0.79%	0.80%
Current Account Deficit (in US$mill)	-4.31	2.84	28.41	39.96	47.22
Current Account Deficit/GDP	0.02%	0.04%	0.08%	0.11%	0.12%
Net International Reserves (US$mill)	28.32	63.19	77.98	86.21	93.08
Net Reserves (in months imports)	0.00	0.00	0.00	0.00	0.00
Total External Debt Ratio	0.77%	1.40%	1.21%	1.13%	1.09%
Public Debt Ratio	0.56%	0.89%	0.58%	0.40%	0.27%

more reserve accumulation, which reduces the financing available from the central bank. The increased imports also lead to more conventional tariff revenues, which raise public saving and lower private saving. The exchange rate devaluation raises the interest cost of public external debt, however, which roughly offsets the increased tariff revenues. The net effect is to lower slightly the amount of public investment that is financeable in the absence of other fiscal adjustment, which lowers growth slightly (by about .1 percentage point). Again, this growth effect could be avoided by raising revenues or cutting other expenditures. In any case the effect on growth is much less than in the case of tariff reductions, and in any case would likely be offset by efficiency improvements that are not captured by the model.

C. Policy Simulation III: Lowering Reserve and Forced Investment Ratio

85. Another policy change that can be addressed by our model is a change in the required reserve ratio of the banking system, as well as a change in their required holdings of low-yielding development fund assets. For this it was necessary to extend the model presented in Part I. Instead of an aggregate monetary sector, we distinguish between the central bank (Banco de la República or BR) and the rest of the banking system (RFS).

86. BR holds all of the international reserves of the banking system (by law). Its other assets are domestic credit to the government, domestic credit to the private sector, and credit to the banking system. The latter includes both rediscounts of development loans and financial support to the banks. The liabilities of BR are currency held by the public, reserves of the banking system, forced investments of the banks in development funds, long-term

TABLE 10
SIMULATION: DIFFERENCES FROM BASE CASE
FISCAL CLOSURE
FORCED INVESTMENT CASE
(With Exchange Rate Adjustment)

	Projected				
	1990	1991	1992	1993	1994
GDP Growth Rate	0.00%	0.03%	-0.11%	-0.11%	-0.11%
Investment Growth Rate	0.27%	-1.49%	-0.13%	-0.04%	-0.03%
Private	1.25%	-0.01%	-0.15%	-0.15%	-0.15%
Public	-1.53%	-4.41%	-0.44%	0.56%	0.41%
GDP per capita Growth Rate	0.00%	0.02%	-0.11%	-0.11%	-0.11%
Consumption per capita growth rate	-0.00%	0.46%	-0.13%	-0.13%	-0.12%
Gross Investment/GDP	0.04%	-0.26%	-0.26%	-0.26%	-0.25%
Domestic Savings/GDP	0.01%	-0.32%	-0.31%	-0.29%	-0.28%
National Savings/GDP	0.01%	-0.30%	-0.29%	-0.29%	-0.28%
Marginal National Savings Rate	0.49%	-6.99%	-0.18%	-0.11%	-0.07%
Private Investment/GDP	0.16%	0.13%	0.13%	0.12%	0.12%
Private Consumption/GDP	-0.01%	0.32%	0.31%	0.29%	0.28%
Private Savings/GDP	0.00%	0.04%	0.03%	0.03%	0.02%
Private Resource Balance/GDP	-0.15%	-0.10%	0.10%	-0.10%	-0.10%
Public Investment/GDP	-0.11%	-0.40%	-0.39%	-0.38%	-0.36%
Public Savings/GDP	0.01%	-0.34%	-0.33%	-0.31%	-0.30%
Public Revenues/GDP	0.01%	0.00%	0.00%	0.00%	-0.00%
Public Expenditures/GDP	-0.11%	-0.05%	-0.06%	-0.07%	-0.07%
Public Deficit/GDP	-0.12%	-0.06%	-0.06%	-0.07%	-0.07%
MLT External Financing	-0.00%	-0.01%	-0.00%	-0.00%	-0.00%
(External Financing availability)	-0.00%	-0.01%	-0.00%	-0.00%	-0.00%
ST External Financing	0.00%	-0.00%	0.00%	-0.00%	-0.00%
Domestic financing-financial system	-0.11%	-0.05%	-0.06%	-0.06%	-0.06%
From Banco de la Republica	-1.69%	-0.36%	-0.35%	-0.35%	-0.34%
From Rest of Financial System	1.58%	0.31%	0.29%	0.29%	0.28%
Domestic financing-private sector	0.00%	0.00%	0.00%	0.00%	0.00%
Residual	0.00%	0.00%	0.00%	0.00%	0.00%
Real exchange rate index	0.16	0.52	0.50	0.53	0.56
Real Exchange Rate Depreciation(-)	0.17%	0.42%	-0.02%	0.04%	0.05%
Domestic Inflation	0.00%	0.00%	0.00%	0.00%	0.00%
Exchange Rate Depreciation	-0.23%	-0.55%	0.03%	-0.05%	-0.06%
Nominal Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Real Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Loan Rate	-3.53%	-3.39%	-3.25%	-3.11%	-2.97%
Real Loan Rate	-2.83%	-2.74%	-2.64%	-2.55%	-2.46%
Government Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Rate on Forced Investment	0.00%	0.00%	0.00%	0.00%	0.00%
Forced Investment Ratio	-3.96%	-3.96%	-3.96%	-3.96%	-3.96%
Reserve ratio	-5.80%	-5.80%	-5.80%	-5.80%	-5.80%
Stock of M1/GDP	0.00%	0.00%	0.00%	0.00%	0.00%
Stock of Quasi-money/GDP	0.00%	0.01%	0.04%	0.06%	0.07%
Stock of credit to private sector/GDP	0.09%	0.16%	0.23%	0.29%	0.33%
Export Growth Rate	-0.06%	-0.14%	-0.03%	-0.05%	-0.06%
Growth rate manufacturing exports	-0.18%	-0.43%	-0.09%	-0.16%	-0.16%
Exports/GDP	-0.05%	-0.17%	-0.16%	-0.15%	-0.15%
Import Growth Rate	0.14%	-0.10%	-0.12%	-0.09%	-0.08%
Growth rate intermediate imports	0.09%	0.27%	-0.13%	-0.09%	-0.08%
Growth rate private capital imports	1.32%	0.17%	-0.16%	-0.14%	-0.13%
Growth rate private cons imports	0.09%	0.76%	-0.15%	-0.11%	-0.10%
Tax Rate on Imports	0.00%	0.00%	0.00%	0.00%	0.00%
Imports/GDP	-0.01%	-0.11%	-0.11%	-0.11%	-0.12%
Current Account Deficit (in US$mill)	13.68	19.78	16.12	16.11	17.10
Current Account Deficit/GDP	0.03%	0.04%	0.03%	0.03%	0.03%
Net International Reserves (US$mill)	7.31	1.81	-3.13	-8.62	-10.09
Net Reserves (in months imports)	0.00	0.00	0.00	0.00	0.00
Total External Debt Ratio	-0.08%	-0.27%	-0.21%	-0.17%	-0.14%
Public Debt Ratio	-0.18%	-0.37%	-0.34%	-0.34%	-0.33%

foreign loans, and net other liabilities. Domestic credit to the government is the residual variable just as in the basic model.

87. The rest of the banking system holds (as assets) credit to the private and public sectors, as well as reserves and forced investments at BR. Its liabilities are demand deposits, quasi-money, short-term and long-term foreign loans, credit from BR, and net other liabilities. As with the central bank, credit to the public sector is the residual item.

88. With this extension of the model, we also need to add an equation that determines the loan interest rate. The deposit interest rate is set as a target in real terms, as before. However, the loan interest rate will be given as the deposit interest rate plus a spread determined by the reserve ratio and forced investment ratio, as well as by the interest rate received by the banks on forced investments.

89. The policy simulation is to lower the ratio of required reserves and forced investments. This lowers the loan rate relative to the deposit rate, thus increasing private investment. It also shifts financing (as the source of loanable funds) from the central bank to the banking system. Since the interest rate and inflation target are fixed, BR must offset the potential expansionary monetary effects by contracting credit to the government (relative to the base case). On the other hand, the banking system can lend more to the government at market interest rates, since it sets less of its portfolio aside for forced investments and reserves at BR. Thus, the overall effect of the policy change is to substitute domestic debt finance of the government for money finance, which raises interest expenditures of the government and lowers government saving.

90. Table 10 shows the outcome of the simulation. The lower government saving forces a reduction of public investment in the absence of other fiscal adjustment. Private investment increases in response to the lower loan interest rate, but not as much as public investment falls. The rate of growth is thus slightly lower (by about .1 percentage point). As with the other policy simulations, this incipient fall in growth (which would probably be offset by efficiency improvements) could be avoided by having other revenues or current expenditures adjust to compensate for the increased interest cost of domestic debt. If public investment is indeed the locus of adjustment, however, the financeable deficit is also reduced slightly by the lower growth rate. The other important effect of this policy change is that the share of private consumption increases because of the reduction in the inflation tax on households. Again, the simulation does not capture the potential gain in productivity growth induced by this policy reform. There are several sources of potential productivity gain. First, the reallocation of investment toward private investment away from public investment, given that the former has a higher rate of return than the latter. Second, the rationalization of the real interest rate (making it equal for all borrowers) would raise the efficiency of all investments. Finally, the greater flexibility bestowed to the financial sector in managing their assets should lead to a more efficient financial sector.

D. Policy Simulation IV: Lowering Inflation

91. The final policy simulation is a reduction in inflation to 10% by 1994 (ten points lower than the base case). This requires a reduction in the fiscal deficit of 1 percentage point of GDP from the base case by 1994, which

TABLE 11
SIMULATION: DIFFERENCES FROM BASE CASE
FISCAL CLOSURE
LOWER INFLATION CASE
(With Exchange Rate Adjustment)

	Projected				
	1990	1991	1992	1993	1994
GDP Growth Rate	-0.00%	-0.02%	-0.11%	-0.22%	-0.35%
Investment Growth Rate	-0.24%	-0.94%	-1.44%	-1.68%	-1.32%
Private	0.06%	0.17%	0.11%	0.01%	-0.26%
Public	-0.80%	-3.05%	-4.82%	-5.19%	-3.37%
GDP per capita Growth Rate	-0.00%	-0.02%	-0.10%	-0.22%	-0.35%
Consumption per capita growth rate	0.02%	0.07%	-0.03%	-0.12%	-0.29%
Gross Investment/GDP	-0.04%	-0.20%	-0.42%	-0.67%	-0.84%
Domestic Savings/GDP	-0.02%	-0.09%	-0.16%	-0.24%	-0.28%
National Savings/GDP	-0.02%	-0.10%	-0.18%	-0.26%	-0.29%
Marginal National Savings Rate	-0.89%	-2.02%	-2.63%	-3.39%	-2.37%
Private Investment/GDP	0.01%	0.04%	0.09%	0.13%	0.15%
Private Consumption/GDP	0.02%	0.09%	0.16%	0.24%	0.28%
Private Savings/GDP	-0.03%	-0.15%	-0.25%	-0.32%	-0.33%
Private Resource Balance/GDP	-0.04%	-0.19%	-0.33%	-0.45%	-0.48%
Public Investment/GDP	-0.06%	-0.25%	-0.51%	-0.80%	-0.99%
Public Savings/GDP	0.01%	0.04%	0.06%	0.06%	0.03%
Public Revenues/GDP	-0.00%	-0.01%	-0.02%	-0.03%	-0.04%
Public Expenditures/GDP	-0.07%	-0.30%	-0.59%	-0.88%	-1.07%
Public Deficit/GDP	-0.06%	-0.29%	-0.57%	-0.86%	-1.03%
MLT External Financing	0.00%	0.00%	0.01%	0.01%	0.02%
(External Financing availability)	0.00%	0.00%	0.01%	0.01%	0.02%
ST External Financing	-0.00%	0.00%	-0.00%	0.00%	0.00%
Domestic financing-financial system	-0.06%	-0.29%	-0.57%	-0.86%	-1.04%
From Banco de la Republica	-0.01%	-0.06%	-0.11%	-0.18%	-0.24%
From Rest of Financial System	-0.06%	-0.24%	-0.46%	-0.69%	-0.79%
Domestic financing-private sector	-0.00%	-0.00%	-0.01%	-0.01%	-0.01%
Residual	0.00%	0.00%	0.00%	0.00%	0.00%
Real exchange rate index	-0.09	-0.34	-0.75	-1.15	-1.32
Real Exchange Rate Depreciation(-)	-0.09%	-0.29%	-0.64%	-0.49%	-0.23%
Domestic Inflation	-1.00%	-4.00%	-7.00%	-10.00%	-11.00%
Exchange Rate Depreciation	-0.91%	-3.64%	-6.23%	-9.10%	-10.44%
Nominal Interest Rate	-1.05%	-4.19%	-7.33%	-10.47%	-11.52%
Real Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Loan Rate	-1.30%	-5.20%	-9.10%	-13.00%	-14.30%
Real Loan Rate	-0.14%	-0.58%	-1.07%	-1.59%	-1.90%
Government Interest Rate	-1.05%	-4.19%	-7.33%	-10.47%	-11.52%
Rate on Forced Investment	0.00%	0.00%	0.00%	0.00%	0.00%
Forced Investment Ratio	0.00%	0.00%	0.00%	0.00%	0.00%
Reserve ratio	0.00%	0.00%	0.00%	0.00%	0.00%
Stock of M1/GDP	0.02%	0.08%	0.15%	0.23%	0.26%
Stock of Quasi-money/GDP	0.11%	0.54%	1.29%	2.40%	3.58%
Stock of credit to private sector/GDP	0.22%	1.11%	2.84%	4.90%	7.34%
Export Growth Rate	0.03%	0.09%	0.14%	0.10%	-0.02%
Growth rate manufacturing exports	0.10%	0.29%	0.43%	0.31%	-0.10%
Exports/GDP	0.03%	0.11%	0.28%	0.46%	0.67%
Import Growth Rate	-0.09%	-0.32%	-0.56%	-0.71%	-0.64%
Growth rate intermediate imports	-0.06%	-0.19%	-0.39%	-0.50%	-0.49%
Growth rate private capital imports	0.02%	0.06%	-0.11%	-0.20%	-0.36%
Growth rate private cons imports	-0.03%	-0.08%	-0.29%	-0.38%	-0.41%
Tax Rate on Imports	0.00%	0.00%	0.00%	0.00%	0.00%
Imports/GDP	0.00%	0.00%	0.02%	0.02%	0.01%
Current Account Deficit (in US$mill)	-8.40	-41.24	-105.11	-193.51	-282.06
Current Account Deficit/GDP	-0.02%	-0.10%	-0.24%	-0.40%	-0.56%
Net International Reserves (US$mill)	-4.66	-22.44	-55.24	-100.36	-144.60
Net Reserves (in months imports)	0.00	0.00	0.00	0.00	0.00
Total External Debt Ratio	0.04%	0.18%	0.42%	0.67%	0.85%
Public Debt Ratio	0.01%	-0.00%	-0.10%	-0.38%	-0.87%

implies a small surplus. It also requires a small amount of additional real depreciation (cumulatively 1.6 percentage points).

92. The decline in inflation implies a drop in monetary financing of the public deficit, which is what forces the deficit reduction. There is also a drop in the nominal flow of debt finance, which reflects the lower nominal accumulation of financial assets by the private sector to meet desired real stocks. This lower financing is partially offset by higher public saving, reflecting lower nominal interest costs. Note that part of the drop in financing and all of the increase in saving is illusory in economic terms. It would disappear if we adjusted domestic interest payments and net borrowing for inflation, since part of the interest payments is implicit amortization to compensate for inflation. However, most of the drop in the deficit is real, so that public investment must be reduced by 1 percentage point of GDP by 1994 in the absence of other measures (Table 11).

93. The reduction in inflation also raises private consumption and lowers private saving. This is because the inflation tax on consumers is reduced, which raises the effective disposable income of consumers and thus consumption. However, measured private saving is reduced since the inflation tax is not formally counted in the national accounts. The reduced inflation also reduces the nominal quantity of money balances accumulated by consumers, by even more than the reduction in saving. This implies a shift toward interest-bearing assets, both domestic and foreign (although nominal domestic quasi-money demand still declines). The higher capital outflow is what leads to the small amount of required real currency depreciation to accompany the inflation reduction.

94. The drop in inflation indirectly increases private investment. The real loan rate falls even though the real deposit rate is unchanged, since lower inflation implies a lower implicit tax through the reserve and forced investment requirements and a lower spread. The private investment increase is less than the drop in public investment, so growth falls slightly from the base case. As with the other scenarios, if fiscal adjustment was achieved without reducing public investment, the drop in growth could be avoided (and even reversed, because of the rise in private investment).[18]

95. There are other complications not captured by the model. Inflation inertia often exists because of implicit or explicit indexation of wage and financial contracts. Supply shocks can have an important effect on the price level, which will change measured inflation even if not affecting the long run tendency. However, this scenario is useful to highlight the macro fundamentals necessary for inflation to fall.

VI. CONCLUSION

96. Both the basic and extended versions of the model prove useful to evaluate macroeconomic policy trade-offs. In the basic version, we analyze trade-offs among different targets (real exchange rate, inflation, and real interest rates), with the fiscal deficit and its financing composition playing the adjusting role. In the extended model, the real exchange rate also

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18/ Another policy simulation increasing inflation to 29% by 1994 was also run -- the exchange rate depreciated by less than the base case, and the public deficit was higher than the base case by .6% of GDP in 1994.

adjusts in order to observe the constraint on external financing. With the extended model, we determine the complementary macro adjustment that will be required by structural reforms such as trade and financial liberalization. The model shows that these reforms generally require reduction of the fiscal deficit. If this is done through public investment cuts, this will have negative consequences for growth, which can be avoided by reducing current expenditures or increasing other public revenues. The model does not explicitly incorporate the favorable growth effects of trade or financial liberalization, which are probably enough to offset even a drop in public investment.

97. This model is an attempt to combine the best of two approaches. In the traditional financial programming exercise, there is considerable attention to accounting detail but little reflection of how economic agents behave. In behavioral macro models, on the other hand, many of the accounting niceties are ignored in favor of aggregate behavioral relationships, which limits their usefulness for designing a macro program. Putting some minimum of behavior into a detailed accounting framework, although costly to implement, is a way to design a macro program to be consistent with both economic intuition and budgetary and monetary accounts.

Appendix I

Technical Implementation of the Model

I. PROGRAMMING OF MODEL IN JAVELIN

The Colombia RMSM-X model was implemented in Javelin by modifying to suit the Colombian economy the existing RMSM-X shell developed by John Holsen, Ali Khadr, Klaus Schmidt-Hebbel, and Jaume Ventura.

As mentioned in the main body of the paper, there are three methods used to project the variables in the model; exogenously, by econometric estimation, or by specifying the variable as a share to GDP that is assumed to remain constant over the projection period.

A. Calculation of Coefficient From Base Period

The nomenclature of the model specifies that assumptions for projected variables are named with a 'z' prefix. The base period coefficients are calculated as follows in Javelin:

Taking Direct Taxes, Td, as an example, the formula would be

```
z Td ZGDP = VALUE(Td/GDP,[1988])
```

This yields the Ratio to GDP of Direct Taxes in 1988; the ratio is then applied to exogenously projected GDP to obtain projected Direct Taxes as follows:

```
Td = z Td ZGDP*GDP
```

Many of the interest rates of the external sector in the model are calculated using averages of historical data. The interest rates on external debt are related to the LIBOR, and the interest rate spread is calculated directly in the formula. For example, the interest rate on external debt of the public sector has been calculated as follows:

```
z Dol INTgf = z Dol INTLibor + VALUE((TSUM(BEGIN([1987],Dol Ngf,2))/
    TSUM(BEGIN([1986],Stk Dol Lfg,2))) - z Dol INTLibor,[1988])
```

The above expression calculates the 1988 value of the interest rate the government paid to the external sector. This interest rate is an average of the interest paid in 1987 and 1988 on the stock of external debt in 1986 and 1987. The LIBOR rate in 1988 is then subtracted from this average interest rate to obtain the spread between the two rates in 1988; this spread is then assumed to hold for the entire projection period, and the government's rate on external debt moves with LIBOR. Other interest rates to which similar versions of this formula were applied include interest on reserves, and the rate on short term external debt of the private sector.

Variables which were projected as constant ratios to GDP or relevant activity variables:

z DFIProfRate	Profits as a share of previous stock of direct foreign investment
z DomCapGgZGDP	Public domestic use of capital goods (in private closure)
z DomCp GDP	Private domestic use of consumer goods
z DomCp YD	Private domestic use of consumer goods as a ratio to disposable income
z DRS ZGDP	Depreciation, interest and retained earnings of the other public sector
z Imp Cg	Public imports of consumer goods as a share of public consumption
z Imp DomCapGg	Public imports of capital goods as a share of public domestic use of capital goods
z ImpShareInv	Imports of capital goods share of total investment
z Lgp ZGDP	Credit from public to private sector
z Lmg ZGDP	Credit from financial to public sector (in private closure)
z Lmp ZIp	Credit from financial to private sector (in fiscal closure)
z LpgZQM	Credit from private sector to government as ratio to quasi-money (in fiscal closure)
z Months Stk NetIntlRes	Stock of Reserves in months imports (in fiscal closure)
z stk NOL ZQM	Net Other Liabilities of financial sector as ratio to quasi-money
z NOLg ZGDP	Net Other Liabilities of government
z OthR ZGDP	Other revenues of public sector
z Subg ZGDP	Government subsidies
z Td ZGDP	Direct Taxes
z Tgp ZGDP	Government transfers to private sector
z Ti.imp ZImp	Import taxes as share of imports (goes into calculating indirect taxes)
z Ti.prod ZGDP	Product taxes (goes into calculating indirect taxes)

B. Implementation of Closure Rule in Javelin

The closure rule is implemented by specifying a variable called Closure, which will be set to either 'private' or 'fiscal'. A series of IF statements are then input in formulas for certain key variables in the model. These IF statements take the form of:

```
Lmg = IF(Closure='private',Stk Lmg-PREVIOUS(Stk Lmg),TotFinCapS-Lmp-NFAc-
NFAof-NFAd)
```

Taking domestic government debt to the financial system as an example, it can be seen that in the private closure, the flow is calculated simply as the change in the stock, while in the fiscal closure, Lmg is the

residual variable for the financial system. In this case there is another IF statement in the equation for stock of Lmg as follows:

```
Stk Lmg = IF(Closure='private',z Lmg %GDP*GDP,BEGIN([1989],PREVIOUS(Stk
      Lmg)+Lmg))
```

Thus, if the private closure is chosen, Lmg is projected as a constant ratio to GDP throughout the projection period; otherwise, in the fiscal closure Lmg is a residual variable, and the current stock of Lmg is calculated by adding the flow in the current period to the stock of the previous period.

Variables for which IF statements were specified:

Dol Knei	Capital nei
Dol Lfg	External financing of government debt
Dol NFAcb	Reserves
Dom CapG g	Public expenditure on domestic capital goods
Dom Cp	Private consumption of domestic goods
K Dom Cp	Private domestic consumption 1988 prices
Lmg	Monetary financing of government debt
Lmp	Financial sector credit to private sector
Lpg	Private sector financing of government debt
Stk Dol NFAcb	Stock of reserves
Stk Lmg	Stock of Lmg
Stk Lmp	Stock of Lmp
Stk Lpg	Stock of Lpg
z Months Stk NetIntlRes	Stock of reserves in months of imports

C. How the Model is Specified so as to be Solved Recursively

With the inclusion of behavioral equations into RMSM-X, simultaneity is created. Certain variables had to be specified differently to allow Javelin to solve the model recursively. This did not impact on the solution of the model; the solution is in effect simultaneous, because the model is implicitly solving for the reduced form for these variables.

One source of circularity in the private closure is private consumption, which was specified as the residual in the National Accounts. This procedure created a circularity within the model when the behavioral equations were entered, because imports, which help determine private consumption, were also dependent upon private consumption. To resolve this programming circularity, private imports of consumption goods were excluded from both sides of the equation, and domestic private consumption then became the residual variable. Private imports of consumption goods were made dependent upon the real exchange rate and domestic private consumption instead of total private consumption. This practice does not change the solution, as long as the share of private consumption imports in domestic private consumption remains constant throughout the projection period. This is because the model is implicitly solving for the reduced form for these variables.

A similar situation exists in the fiscal closure. Public investment was to be the residual variable for the national accounts, but imports, which partly determine public investment, at the same time depend on investment. Again, this problem was resolved by excluding from the identity public imports of capital goods. Domestic use of capital goods by the public sector became the residual, and now private imports of capital goods are determined by the real exchange rate and private investment.

Another source of simultaneity which applies to both closures is the relationship between imports, private consumption, and disposable income. Imports turn out to be partly determined by variables which are in turn dependent upon imports. Imports are determined by private consumption, which depends upon disposable income, which is partly determined by indirect taxes, which are calculated by using imports. Adjusted disposable income was defined in order to circumvent this problem. This new variable excludes taxes on private consumption imports as well as government imports from its calculation of indirect taxes. Now private consumption imports depend on adjusted disposable income, and adjusted disposable income is no longer determined by imports of consumer goods. Again, this is equivalent to solving for the reduced form of consumption as a function of variables outside the simultaneous system. However, the share of private domestic consumption in adjusted disposable income should include the effect of taxes on consumption imports. In the model this share is constant, and therefore does not capture the effect of changes in consumption import taxes on private domestic consumption. However it is expected that this effect will be very small, so its exclusion does not present a major problem to the model.

Adjusted disposable income also excludes the inflationary component of interest on the government deficit. This is a behavioral assumption -- that the private sector treats the inflationary component of interest as implicit amortization rather than as income.

II. ESTIMATION OF UNDERLYING PARAMETERS OF THE MODEL

A. Regression Results for Money Demand and Quasi-Money

Estimations for money demand and quasi-money were performed in TSP on data with a sample range of 1966 to 1988 for money demand and 1972 to 1988 for quasi-money. For money demand, GDP and the average inflation rate were found to be significant, with a correction for autocorrelation. The nominal interest rate was substituted for the inflation rate, but was not found to be significant. The real interest rate and GDP were found to be significant in determining quasi-money. Coefficients for inflation in money demand and the real interest rate in quasi-money were used in the behavioral equations in RMSM-X. For quasimoney estimations, GDP is a proxy for wealth. In the extended version, quasimoney is tied to wealth as opposed to nominal GDP in the basic model.

Because the series are likely to be cointegrated, in the extended model new regressions were run using money and quasimoney ratios to GDP. The same relationships were found to exist as in the previous regressions; that is, average inflation is significant in determining the ratio of money to GDP, and the ratio of quasimoney to GDP is significantly determined by the real interest rate.

B. Import and export elasticities

In the original version of the model, price elasticities for various categories of imports and exports were obtained from the Colombia CEM of April 21, 1989, and from the Colombia Division. These are the same elasticities used for the previous version of the RMSM in the Colombia division. Estimations were performed on volumes of manufacturing and other exports, and consumer, capital goods, and intermediate imports. Both types of exports are determined by the real exchange rate and GDP. All imports are functions of the real exchange rate. Private imports of capital goods are a function of private investment, private imports of consumer goods are a function of private domestic consumption, and imports of raw materials and intermediaries are a function of GDP.

In the extended version of the model, new regressions were run in SORITEC for import and export demand using the variables' ratios to GDP, as was done with money and quasimoney demand, since import and export variables are presumed to be cointegrated with GDP. All imports' sample range was 1970-1988; for exports it was 1965-1988. After correcting for autocorrelation, the real exchange rate was found to be significant in determining imports of raw materials and intermediaries and exports of manufactures at the 10% level. The same relationship existed for other categories of imports and exports, although not as significantly. Nevertheless, the elasticities were used in the model, since these represent the best available estimates.[19]

C. Parameterization to obtain well-behaved model solution

In order to obtain reasonable simulation results, the elasticity of private investment with respect to the real loan rate was set equal to -.5 in the model after experimenting with different values. Econometric estimates of this parameter were inconclusive. The income elasticity of private investment demand was set to 1.

III. PROGRAMMING OF THE EXCHANGE RATE RULE

Implementing Exchange Rate Adjustment in Javelin

In the original version of the model, real exchange rate appreciation or depreciation was exogenous. In the extended model the real exchange rate becomes the adjusting variable when public sector foreign borrowing is constrained to be consistent with the available external credit supply. To solve for the appropriate devaluation rate, the model goes through three iterations each projection year. The first two iterations are required to calculate the relationship between the size of the gapfil -- the gap between available external financing and public sector foreign borrowing -- and devaluation, which in this case turns out to be linear. In the third iteration this relationship is used to calculate the appropriate devaluation rate, which is then applied to the model for that particular year.

19/ It should be noted that simulation results are sensitive to parameter estimates from these regressions, since these estimates go directly into the model.

Defining New Variables

To implement the exchange rate algorithm, the following changes and additions were made:

* Real exchange rate depreciation (z (ExRRGR) is redefined:

  z ExRRGR = z ExRRGR iterative + delta ExRRGR

  where delta ExRRGR is the increment by which the exchange rate is devalued in each iteration, and z ExRRGR iterative is z ExRRGR in the previous iteration.

* Dol Lfg Gapfil is the difference between available external financing and public sector foreign borrowing.

* Gapfil Last is Dol Lfg Gapfil in the previous iteration.

* d ExRRGR = -(Gapfil Last/alpha)

* alpha = (Dol Lfg Gapfil-Gapfil Last)/delta ExRRGR

The Macro

The exchange rate macro consists of a series of macros written for each year which will define the setting of the model to that year, then go through the three iterations. The first iteration applies an arbitrary devaluation rate of .5% then copies over the calculated Dol Lfg Gapfil to Galfil Last, and z ExRRGR over to z ExRRGR iterative. The model then goes through the second iteration, which yields the new Dol Lfg Gapfil, so that alpha and d ExRRGR are now calculated. In the third iteration, d ExRRGR, which is the appropriate devaluation rate is copied over to delta ExRRGR, and the model is solved. This solution process reduces the gapfil to less than .00025 percent of GDP.

LS // Dependent Variable is LMICPD
Date: 2-02-1990 / Time: 12:3.
SMPL range: 1966 - 1988
Number of observations: 23
Convergence achieved after 3 iterations

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	2.9047133	3.0486364	0.9527910	0.353
AVEINFL	-0.3045083	0.1410502	-2.1588657	0.044
LGDP	0.6335572	0.2305463	2.7480693	0.013
AR(1)	0.7695571	0.1676160	4.5911917	0.000

R-squared	0.973825	Mean of dependent var	11.03738
Adjusted R-squared	0.969692	S.D. of dependent var	0.243088
S.E. of regression	0.042320	Sum of squared resid	0.034028
Durbin-Watson stat	2.103430	F-statistic	235.6271
Log likelihood	42.29915		

LS // Dependent Variable is LQMCPD
Date: 2-02-1990 / Time: 12:35
SMPL range: 1972 - 1988
Number of observations: 17

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-21.304437	2.1811149	-9.7676822	0.000
RLR3	2.2556404	0.4852402	4.6485031	0.000
LGDP	2.4094979	0.1670710	14.422002	0.000

R-squared	0.975850	Mean of dependent var	10.38894
Adjusted R-squared	0.972400	S.D. of dependent var	0.599062
S.E. of regression	0.099524	Sum of squared resid	0.138672
Durbin-Watson stat	1.555003	F-statistic	282.8500
Log likelihood	16.75335		

LS // Dependent Variable is LM1C
Date: 2-02-1990 / Time: 12:33
SMPL range: 1966 - 1988
Number of observations: 23
Convergence achieved after 7 iterations

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-2.2483145	1.5343875	-1.4652847	0.158
AVEINFL	-0.2897924	0.1379396	-2.1008651	0.049
AR(1)	0.9771435	0.1314224	7.4351343	0.000

R-squared	0.790959	Mean of dependent var	-1.934627
Adjusted R-squared	0.770055	S.D. of dependent var	0.095517
S.E. of regression	0.045803	Sum of squared resid	0.041958
Durbin-Watson stat	2.104275	F-statistic	37.83760
Log likelihood	39.89006		

LS // Dependent Variable is LQMC
Date: 2-02-1990 / Time: 12:33
SMPL range: 1973 - 1988
Number of observations: 16
Convergence achieved after 3 iterations

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-2.4395555	0.2673102	-9.1263090	0.000
RLR3	1.4319982	0.6488352	2.2070291	0.046
AR(1)	0.8499039	0.0876740	9.6939057	0.000

R-squared	0.919953	Mean of dependent var	-2.686052
Adjusted R-squared	0.907638	S.D. of dependent var	0.375226
S.E. of regression	0.114036	Sum of squared resid	0.169054
Durbin-Watson stat	1.895396	F-statistic	74.70189
Log likelihood	13.69799		

Estimations of import and export volume for Colombia RMSM-X

IMPORTS — Source: Colombia Division

Consumer $CV_t = -0.372*(-RER_t) + 0.984*(CP_t)$

Intermediate $IV_t = -0.226*(-RER_t) + 0.705*(GDP_t) + 0.479*(IV_{t-1})$

Capital $KV_t = -0.509*(-RER_t) + 0.668*(FK_t) + 0.363*(KV_{t-1})$

Where variables are in changes, except otherwise indicated

CV - Volume of consumer goods imports
CP - Real growth in private consumption
IV - Volume of raw materials and intermediate goods imports
KV - Volume of capital goods imports
GDP - GDP
FK - Change in real levels of total fixed investment
RER - Real exchange rate change
(Domestic Price Index/Exchange Rate*World Price Index)

EXPORTS — Source: CEM, April 21, 1989.

Manufactures XMANU = -8.890 + 0.789*RPX + 1.425*CAPV
(1.96) (4.94)

XMANU - Export supply of manufactured goods and constant dollar prices.
RPX - Ratio of price of manufactured export goods in dollar terms to home good prices in dollar terms, which are defined as industrial wage index.
CAPV - Capacity variable, constructed as the fitted value of the following regression :

$LSCALE = a_0 + a_1 * LSCALE(-1) + a_2 * LRPMANPH(-1) + e$

where LSCALE is the value added in the manufactures sector at constant prices; and
LRPMANPH is the ratio of the price of manufactured goods to domestic goods

Other XOTM = -10.41 - 0.715*RPX + 1.190*CAPV
(1.55) (5.15)

XOTM - Exports of menores minus manufactured exports as defined by Colombia's central bank. Deflated by the World MUV.
RPX - Industrial real wages denominated in dollars.
CAPV - Capacity variable, constructed in the same manner as CAPV in the manufactures regression, substituting LPMAN for LRPMANPH, defined as follows:

LSCALE is real GDP and LPMAN is the ratio of domestic prices to manufactured goods prices.

```
   SORITEC    | PCDOS 400796
   6.4.003    | RMSMX TRADE REGS
(C) 1988 SGI  |
```

CORC : dependent variable is LMCAPC

Using 1971 - 1987

Variable	Coefficient	Std Err	T-stat	Signf
^CONST	-5.06982	1.82830	-2.77297	0.014
LREER	0.435335	0.387663	1.12297	0.279
^RHO	0.593149	0.195264	3.03768	0.008

```
---------- Equation Summary ----------
No. of Observations =     17      R2= 0.5344   (adj)= 0.5034
Sum of Sq. Resid. =  0.335657     Std. Error of Reg.= 0.149590
Log(likelihood)   =  9.23951      Durbin-Watson     =  1.47945
Schwarz Criterion =  6.40630      F (  1,   15)     =   17.2169
Akaike Criterion  =  7.23951      Significance      =  0.000856

---- ---------- Autocorrelation Estimation Summary ----------
Initial Rho(1)       =  0.00000     Final Rho(1)       =  0.59315
Std Error of Rho(1) =  0.19526      t-value (sig) =  3.038 (0.008)
R-Squared based on transformed (differenced) model =     0.23814
Convergence at iteration    4
```

```
   SORITEC    | PCDOS 400796
   6.4.003    | RMSMX TRADE REGS
(C) 1988 SGI  |
```

CORC : dependent variable is LMCONC

Using 1971 - 1987

Variable	Coefficient	Std Err	T-stat	Signf
^CONST	-6.70702	2.23417	-3.00202	0.009
LREER	0.561831	0.473734	1.18596	0.254
^RHO	0.594465	0.195028	3.04810	0.008

```
---------- Equation Summary ----------
No. of Observations =     17      R2= 0.5014   (adj)= 0.4682
Sum of Sq. Resid. =  0.500684     Std. Error of Reg.= 0.182699
Log(likelihood)   =  5.84048      Durbin-Watson     =   .54030
Schwarz Criterion =  3.00727      F (  1,   15)     =   15.0871
Akaike Criterion  =  3.84048      Significance      =  0.001468

---------- Autocorrelation Estimation Summary ----------
Initial Rho(1)       =  0.00000     Final Rho(1)       =  0.59647
Std Error of Rho(1) =  0.19503      t-value (sig) =  3.048 (0.008)
R-Squared based on transformed (differenced) model =     0.22036
Convergence at iteration    3
```

```
   SORITEC    | PCDOS 400796
   6.4.003    | RMSMX TRADE REGS
(C) 1988 SGI  |
-------------------------------------------------------------------------------

CORC : dependent variable is LMRMIC

Using     1971   -  1987

   Variable        | Coefficient |   Std Err   |   T-stat    | Signf
-------------------|-------------|-------------|-------------|------
^CONST             |  -5.28042   |  1.43164    |  -3.68837   | 0.002
LREER              |  0.573269   | 0.303921    |   1.88624   | 0.079
^RHO               |  0.634466   | 0.187468    |   3.38440   | 0.004


   ---------------------- Equation Summary ---------------------
   No. of Observations =      17       R2= 0.6006   (adj)= 0.5740
   Sum of Sq. Resid. =  0.197615       Std. Error of Reg.= 0.114779
   Log(likelihood)   =   13.7426       Durbin-Watson     =  2.08839
   Schwarz Criterion =   10.9094       F (  1,   15)     =   22.5545
   Akaike Criterion  =   11.7426       Significance      =  0.000258

   -------------- Autocorrelation Estimation Summary --------------
   Initial Rho(1)      =  0.00000      Final Rho(1)      =  0.63447
   Std Error of Rho(1) =  0.18747      t-value (sig) =   3.384 (0.004)
   R-Squared based on transformed (differenced) model =     0.30752
   Convergence at iteration   3

   SORITEC    | PCDOS 400796
   6.4.003    | RMSMX TRADE REGS
(C) 1988 SGI  |
-------------------------------------------------------------------------------

CORC : dependent variable is LXMFGC

Using     1966   -  1987

   Variable        | Coefficient |   Std Err   |   T-stat    | Signf
-------------------|-------------|-------------|-------------|------
^CONST             |   1.24067   |  2.67308    |  0.464134   | 0.648
LREER              |  -1.07617   | 0.563600    |  -1.90946   | 0.071
^RHO               |  0.595799   | 0.171229    |   3.47955   | 0.002


   ---------------------- Equation Summary ---------------------
   No. of Observations =      22       R2= 0.5390   (adj)= 0.5160
   Sum of Sq. Resid. =   1.03489       Std. Error of Reg.= 0.227475
   Log(likelihood)   =   2.40753       Durbin-Watson     =  1.57429
   Schwarz Criterion = -0.683514       F (  1,   20)     =   23.3882
   Akaike Criterion  =  0.407528       Significance      =  0.000100

   -------------- Autocorrelation Estimation Summary --------------
   Initial Rho(1)      =  0.00000      Final Rho(1)      =  0.59580
   Std Error of Rho(1) =  0.17123      t-value (sig) =   3.480 (0.002)
   R-Squared based on trsnaformed (differenced) model =     0.29124
   Convergence at iteration   2
```

Variable list for Estimations

Variable	Description	Source
AVEINFL	CPI Inflation	IFS
LGDP	Log of GDP	Derived
LM1CPD	Log of M1 deflated by Priv Cons Deflator	Derived
LM1C	LM1CPD-LGDP	Derived
LMCAP	Log of Imports of Capital Goods	Derived
LMCAPC	LMCAP-LGDP	Derived
LMCON	Log of Imports of Consumer Goods	Derived
LMCONC	LMCON-LGDP	Derived
LMRMI	Log of Imports of Raw Mat.&Intermediates	Derived
LMRMIC	LMRMI-LGDP	Derived
LQMCPD	Log of Quasi-Money/Priv Cons Defl.	Derived
LQMC	LQMCPD-LGDP	Derived
LREER	Log of the Real Exchange Rate	Derived
LXMFG	Log of Exports of Manufactures	Derived
LXMFGC	LXMFG-LGDP	Derived
RLR3	Real Interest Rate (1+INTRAT)/(1+CPDYTY)	Derived

Variables from which above variables were derived

(CPD)	Private Consumption Deflator	CN
(CPDYTY)	Change in Priv. Cons Defl.	Derived
(INTRAT)	Nominal Interest Rate	Revista
(GDP)	Gross Domestic Product	CN
(M1)	Money	Revista,CEM
(MCAP)	Imports of Capital Goods	Colombia Div.
(MCON)	Imports of Consumer Goods	Colombia Div.
(MRMI)	Imports of Raw Mat.&Intermediates	Colombia Div.
(REER)	Real Exchange Rate	CECMG database
(XMFG)	Exports of Manufactures	BESD-IECTRD
(QM)	Quasi-Money	Revista,CEM

BESD-IECTRD : Bank Economic and Social Database, International Economics, Trade
CN : Cuentas Nacionales de Colombia
IFS : International Financial Statistics
CEM : Country Economic Memorandum (April 21,1989)
Revista: Revista del Banco de la Republica (various years)

Appendix II

Simulations of the Private Sector Closure

In order to see how the model behaves differently when we change from the fiscal to the private closure described in section II of the paper, we perform the same three alternative simulations done in the main text of the paper. To recap briefly the working of the model under the private closure, the public sector accounts are exogenously projected as constant ratios to GDP. The only exception are taxes and interest payments. Taxes include one component that is projected as a ratio to imports (trade taxes). Interest payments are calculated as last period's debt stock times the current applicable interest rate. In any case, the public sector deficit is determined "above the line" rather than by financing availability.

The current account of the balance of payments is projected on the basis of exogenous commodity developments and the behavioral response to the real exchange rate, just as in the fiscal closure. Net disbursements of foreign debt and direct foreign investment are projected exogenously, and the change in foreign exchange reserves is the residual for the balance of payments.

Private investment, money demand, and quasi-money demand are given by behavioral equations, just as in the fiscal closure. However, private consumption (and saving) is given as the residual to balance the national accounts identity instead of being determined as a ratio to disposable income. The stock of credit from the financial system to the public sector is given as a fixed ratio to GDP; credit to the private sector is the residual for the financial system. To reconcile the projected "above the line" fiscal deficit with financing availability, the private sector is assumed to accumulate enough new government debt to fill the public financing gap.

We first solve the model for the base case for the private closure, as shown in Table A2.1. We then solve the model for the three alternate cases in which a target variable changes and consider the differences between the base case and the alternative solutions.

A. Real Exchange Rate Appreciation

Table A2.2 shows the differences from the base case for a real exchange rate appreciation of 1.8% per year beginning in 1990, with a cumulative real appreciation of 11% by 1995. The appreciation increases the current account deficit by 0.8 percentage points of GDP by the end of the period as import volume rises and export volume falls. Since external financing flows are unchanged, this results in a cumulative loss of reserves of $2.3 billion by 1995 compared to the base case and a decline in import coverage from 7.3 months to 4.8 months.

Unlike the fiscal closure, the public deficit changes very little as a result of real appreciation under the fiscal closure. Fiscal revenues drop slightly because of the valuation effect of real appreciation on income from trade taxes. Current expenditures fall somewhat more because of the lower

real value of external interest payments. Public investment as a ratio to GDP is unchanged because it is projected exogenously. The external financing of the public deficit decreases by somewhat more than the fall in the deficit because of the lower domestic currency value of the projected dollar net disbursements to the public sector. This means that private accumulation of government debt must rise slightly to fill the gap.

Private investment does fall slightly for the same reason as in the fiscal closure, the fall in the relative price of capital goods due to their high import content. Since all of the other components of GDP do not change very much, private consumption must increase strongly (and private saving fall) in response to the increase in the current account deficit. The increase in private consumption is financed by credit from the financial system, which in turn is financed by the running down of foreign exchange reserves held by the financial system.

The economic story behind of this simulation is that of a real exchange rate appreciation induced by a credit-financed private consumption boom. This is a possible outcome, but the model itself does not tell us why private consumption should be booming.

B. Increase in the Real Interest Rate

Table A2.3 shows the differences in key variables from the base case when the real interest rate is increased by 7.3 percentage points after 1990. Unlike the previous simulation, the effect on the current account is negligible, coming out only because of the drop in private investment--and thus capital goods imports--induced by the higher real interest rates.

However, the public deficit now increases strongly because of the higher real interest rate. Unlike the fiscal closure, this results not from increased financing availability but from changes in the fiscal accounts "above the line". The higher interest rates increase government interest costs on its domestic debt. The higher deficit must be financed by issuing more domestic debt to the private sector (recall that this is the residual for the private closure). The higher debt in turn leads to more interest spending. A domestic debt spiral is underway, fueled by a real domestic interest rate (10%) that far exceeds the growth rate (4%).

The fall in private investment is not sufficient to compensate for the increase in the public deficit, so private saving also must increase. However, increased interest on domestic government debt raises the private sector's disposable income, so that private consumption can also increase. The increase in private saving and fall in private investment make possible the accumulation of domestic government debt. The higher interest rate induces more private holding of quasi-money and other liabilities of the financial system. Credit to the private sector increases by an offsetting amount, since this is the residual for the financial system. The effect of higher interest rates on the financial system is therefore a neutral "financial deepening".

The economic story for this simulation would be that a boomlet in private consumption raises real interest rates, which increases the government deficit and leads to a public domestic debt spiral, which at the same time crowds out private investment. Again, the model does not furnish an explanation for the original disturbance to private consumption.

C. Increase in Inflation

Table A2.4 shows the differences from the base case for a simulation in which inflation increases by 6 percentage points after 1990. The nominal government interest rate is assumed to be fixed, so the real government interest rate decreases. This decreases the public sector deficit by .3 percentage points of GDP. At the same time it increases the nominal flow of financing to the government for the fixed ratio to GDP of public debt to the financial system. Since private holdings of government debt are the residual to reconcile the public deficit with its financing, these holdings decrease. The net effect is a decline in the public debt ratio, which further reduces interest costs in the latter part of the period. This a virtuous cycle of domestic debt decumulation in contrast to the vicious cycle in the higher real interest rate simulation.

Since public saving increases by .3% of GDP and the current account deficit and private investment do not change, private saving must decrease by a commensurate amount. However, this is also the amount by which private disposable income decreases because of the lower real value of interest received from the public sector, so private consumption itself does not change.

The private sector also has higher accumulation of money and quasi-money to keep up with the higher inflation. It finances this and its decrease in saving through the reduction in its holding of government debt and through higher credit from the financial system.

The economic story underlying this simulation would be that credit expansion to the private sector increases inflation. The increase in inflation lowers the government deficit and private disposable income by the same amount because of the fixed interest rate on government debt, which is income to the private sector and expenditure for the public sector. The private sector maintains consumption at its original level despite its drop in disposable income, financed by the additional credit that it receives from the monetary system. Thus, private saving decreases by an amount equal to the drop in the public deficit.

Therefore, in this simulation nothing has really changed in real terms. The only change is higher inflation due to an unexplained credit expansion by the financial system to the private sector. The government receives, and the private sector pays, an inflation tax. The financing made possible by money creation goes to the private sector to cover its payment of the inflation tax, while the public sector debt declines as a ratio to GDP.

D. Conclusion

To summarize the comparative simulation results, Figure A2 shows a graph of the differences from the base case in the current account deficit, public resource balance, and private resource balance.

In the exchange rate appreciation case, we find the public deficit improving slightly because of the lower real cost of interest on the external debt. The counterpart to the increased current account deficit is a deterio-

ration in the private resource balance, which is due to higher consumption and lower saving. This contrasts to the fiscal closure, where the higher current account deficit was associated with a larger fiscal deficit. Similarly, in the high inflation case the public deficit is now lower (higher public resource balance) because of the lower real interest cost on the domestic debt. The counterpart is again lower private saving and higher consumption. Finally, the public balance deteriorates in the case of higher real domestic interest rates because of higher total interest on the public debt. The counterpart is lower investment by the private sector in response to the higher interest rates.

These simulation results show the outcomes of changes in policy targets when we take the private sector as the residual in conformity with the traditional RMSM. The simulation results can reproduce outcomes that have been observed in various countries at different times: real exchange rate appreciation associated with a private consumption boom, high real interest rates and a consumption boom, and inflation associated with credit expansion to the private sector. However, the results are unsatisfactory in that the model itself does not explain why the changes in private behavior are taking place. (The fiscal closure also does not explain why the public sector changes its behavior, but it is more common to view government actions as inexplicable.) In its current version, the model gives more satisfactory results with a fiscal closure. If the capability to reproduce major shifts in private consumption ratios is desired, then a richer specification for private consumption is needed. This would be more appropriate for the RMSM-XX version of the macro-modelling exercise.

FIGURE A2

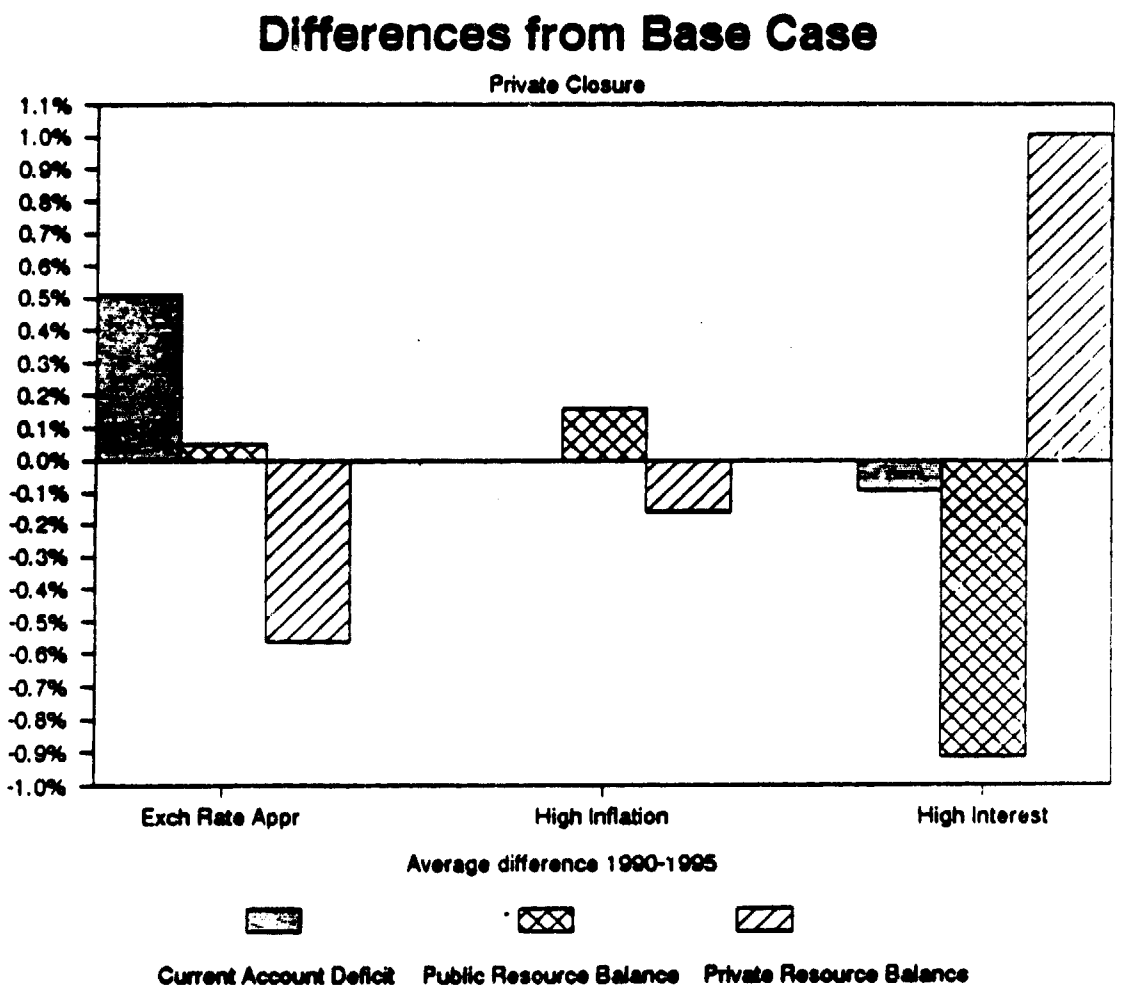
Differences from Base Case
Private Closure
1.1%
1.0%
0.9%
0.8%
0.7%
0.6%
0.5%
0.4%
0.3%
0.2%
0.1%
0.0%
-0.1%
-0.2%
-0.3%
-0.4%
-0.5%
-0.6%
-0.7%
-0.8%
-0.9%
-1.0%
Exch Rate Appr
High Inflation
High Interest
Average difference 1990-1995
Current Account Deficit
Public Resource Balance
Private Resource Balance

TABLE A2.1
MODEL SIMULATION
PRIVATE CLOSURE
Base Case

	Historical	Estimated			Projected					
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
GDP Growth Rate		5.3%	3.8%	3.8%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Investment Growth Rate		4.1%	7.8%	3.8%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Private	-15.6%	8.4%	3.0%	3.8%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Public		-13.5%	11.2%	3.7%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
GDP per capita Growth Rate				2.0%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%
Consumption per capita growth rate				0.0%	1.2%	1.7%	1.2%	3.0%	2.6%	2.7%
Gross Investment/GDP	18.0%	19.5%	20.6%	20.6%	20.6%	20.6%	20.6%	20.6%	20.6%	20.6%
Domestic Savings/GDP	21.8%	21.8%	21.4%	22.0%	21.7%	22.4%	22.8%	22.0%	21.7%	21.4%
National Savings/GDP	19.6%	19.7%	19.7%	19.1%	19.2%	20.3%	20.6%	20.0%	19.9%	19.7%
Marginal National Savings Rate	20.4%	-32.4%	18.9%	6.0%	21.8%	49.3%	30.5%	5.8%	20.1%	15.2%
Private Investment/GDP	11.3%	13.5%	14.1%	14.1%	14.1%	14.1%	14.1%	14.1%	14.1%	14.1%
Private Consumption/GDP	69.0%	69.4%	69.8%	69.0%	69.3%	68.6%	68.2%	69.0%	69.3%	69.6%
Private Savings/GDP	12.1%	14.4%	14.3%	14.7%	14.4%	15.0%	15.4%	14.6%	14.3%	14.0%
Private Resource Balance/GDP	0.7%	0.8%	0.2%	0.6%	0.3%	1.0%	1.4%	0.5%	0.3%	-0.1%
Public Investment/GDP	6.7%	6.0%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
Public Savings/GDP	7.6%	5.4%	5.4%	4.4%	4.7%	5.2%	5.2%	5.3%	5.6%	5.7%
Public Revenues/GDP	24.7%	22.7%	22.[illegible]	22.4%	22.4%	22.4%	22.4%	22.4%	22.4%	22.4%
Public Expenditures/GDP	25.0%	24.5%	24.[illegible]	25.5%	25.2%	24.7%	24.6%	24.6%	24.4%	24.2%
Public Deficit/GDP	0.3%	1.8%	2.1%	3.1%	2.8%	2.3%	2.4%	2.2%	2.0%	1.8%
MLT External Financing	4.4%	0.4%	1.6%	1.1%	0.9%	1.3%	1.1%	0.9%	0.9%	1.1%
ST External Financing	-2.8%	-0.3%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Domestic financing-financial system	-2.6%	2.1%	1.3%	1.1%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Domestic financing-private sector	0.0%	0.4%	0.1%	2.0%	1.9%	1.0%	1.3%	1.3%	1.1%	0.7%
Residual	1.4%	-0.7%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Real exchange rate index			100.0	99.5	99.5	99.5	99.5	99.5	99.5	99.5
Real Exchange Rate Depreciation(-)				-0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Domestic Inflation		22.8%	28.4%	25.0%	23.0%	22.0%	22.0%	22.0%	22.0%	22.0%
Exchange Rate Depreciation		24.9%	23.3%	22.1%	16.6%	15.6%	15.6%	15.6%	15.6%	15.6%
Nominal Interest Rate	31.2%	34.2%	31.8%	28.4%	26.3%	25.3%	25.3%	25.3%	25.3%	25.3%
Real Interest Rate	31.2%	9.3%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%
Government Interest Rate	22.7%	25.5%	23.3%	20.0%	18.1%	17.2%	17.2%	17.2%	17.2%	17.2%
Stock of M1/GDP	11.6%	11.9%	11.3%	11.3%	11.4%	11.4%	11.4%	11.4%	11.4%	11.4%
Stock of Quasi-money/GDP	21.5%	21.4%	19.5%	19.5%	19.5%	19.5%	19.5%	19.5%	19.5%	19.5%
Stock of credit to private sector/GDP	34.2%	35.4%	34.9%	36.1%	36.8%	35.7%	34.8%	35.2%	35.6%	36.0%
Export Growth Rate		7.5%	-1.4%	12.7%	8.1%	6.0%	7.8%	0.7%	2.4%	1.9%
Growth rate manufacturing exports				4.2%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Exports/GDP	19.0%	17.8%	17.0%	17.6%	17.3%	17.9%	18.3%	17.5%	17.3%	17.0%
Import Growth Rate		-4.1%	-4.4%	3.5%	3.9%	4.0%	3.9%	4.1%	4.0%	4.0%
Growth rate intermediate imports				3.7%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Growth rate private capital imports	-15.6%	8.4%	3.0%	3.5%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Growth rate private cons imports		3.5%	4.3%	0.7%	2.9%	3.4%	2.9%	5.0%	4.5%	4.6%
Imports/GDP	15.2%	15.5%	16.2%	16.2%	16.2%	16.2%	16.1%	16.2%	16.2%	16.2%
Current Account Deficit (in US$million)	-566	-75	353	605	658	156	10	392	461	679
Current Account Deficit/GDP	-1.6%	-0.2%	0.9%	1.5%	1.4%	0.3%	0.0%	0.7%	0.7%	0.9%
Net International Reserves (US$million)	3512	3484	3836	3843	3937	4880	5845	6280	6697	7114
Net Reserves (in months imports)	7.91	7.46	7.29	6.86	6.41	7.25	7.92	7.75	7.53	7.28
Total External Debt Ratio	39.4%	42.5%	39.8%	38.2%	35.7%	33.8%	31.8%	29.8%	27.9%	26.4%
Public Debt Ratio	38.5%	42.8%	40.8%	41.4%	40.5%	39.1%	37.9%	36.6%	35.1%	33.7%

TABLE A2.2
SIMULATION : DIFFERENCES FROM BASE CASE
PRIVATE CLOSURE
EXCHANGE RATE APPRECIATION

	1990	1991	1992	1993	1994	1995
GDP Growth Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Investment Growth Rate	0.11%	0.11%	0.11%	0.11%	0.11%	0.10%
Private	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Public	0.35%	0.35%	0.34%	0.34%	0.33%	0.33%
GDP per capita Growth Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Consumption per capita growth rate	0.19%	0.19%	0.19%	0.19%	0.19%	0.18%
Gross Investment/GDP	-0.05%	-0.09%	-0.14%	-0.18%	-0.23%	-0.27%
Domestic Savings/GDP	-0.22%	-0.46%	-0.70%	-0.86%	-1.04%	-1.20%
National Savings/GDP	-0.18%	-0.39%	-0.61%	-0.77%	-0.96%	-1.13%
Marginal National Savings Rate	-1.57%	-2.37%	-2.53%	-3.29%	-3.69%	-4.03%
Private Investment/GDP	-0.05%	-0.09%	-0.14%	-0.18%	-0.23%	-0.27%
Private Consumption/GDP	0.22%	0.46%	0.70%	0.86%	1.04%	1.20%
Private Savings/GDP	-0.21%	-0.43%	-0.67%	-0.84%	-1.02%	-1.18%
Private Resource Balance/GDP	-0.16%	-0.34%	-0.53%	-0.66%	-0.79%	-0.91%
Public Investment/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Public Savings/GDP	0.03%	0.04%	0.06%	0.07%	0.06%	0.05%
Public Revenues/GDP	-0.03%	-0.06%	-0.09%	-0.12%	-0.15%	-0.18%
Public Expenditures/GDP	-0.06%	-0.10%	-0.16%	-0.19%	-0.21%	-0.23%
Public Deficit/GDP	-0.03%	-0.04%	-0.06%	-0.07%	-0.06%	-0.05%
MLT External Financing	-0.02%	-0.05%	-0.06%	-0.06%	-0.08%	-0.11%
ST External Financing	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic financing-financial system	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic financing-private sector	-0.01%	0.00%	-0.00%	-0.00%	0.02%	0.06%
Residual	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Real exchange rate index	0.02	0.04	0.06	0.07	0.09	0.11
Real Exchange Rate Depreciation(-)	1.80%	1.80%	1.80%	1.80%	1.80%	1.80%
Domestic Inflation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Exchange Rate Depreciation	-2.06%	-2.04%	-2.04%	-2.04%	-2.04%	-2.04%
Nominal Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Real Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Government Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Stock of M1/GDP	-0.00%	-0.00%	-0.00%	-0.00%	-0.00%	-0.00%
Stock of Quasi-money/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Stock of credit to private sector/GDP	0.16%	0.50%	0.96%	1.44%	1.98%	2.57%
Export Growth Rate	-0.39%	-0.35%	-0.34%	-0.38%	-0.36%	-0.37%
Growth rate manufacturing exports	-1.42%	-1.42%	-1.42%	-1.42%	-1.42%	-1.42%
Exports/GDP	-0.37%	-0.75%	-1.13%	-1.43%	-1.75%	-2.04%
Import Growth Rate	0.61%	0.61%	0.62%	0.62%	0.63%	0.63%
Growth rate intermediate imports	0.41%	0.41%	0.41%	0.41%	0.41%	0.41%
Growth rate private capital imports	0.92%	0.92%	0.92%	0.92%	0.92%	0.92%
Growth rate private cons imports	1.99%	1.98%	1.99%	1.99%	1.98%	1.98%
Imports/GDP	-0.19%	-0.38%	-0.57%	-0.75%	-0.93%	-1.11%
Current Account Deficit (in US$million)	72	162	274	409	570	766
Current Account Deficit/GDP	0.13%	0.30%	0.47%	0.59%	0.73%	0.85%
Net International Reserves (US$million)	-72	-233	-507	-916	-1487	-2253
Net Reserves (in months imports)	-0.2	-0.4	-0.8	-1.3	-1.8	-2.5
Total External Debt Ratio	-0.63%	-1.18%	-1.66%	-2.05%	-2.38%	-2.68%
Public Debt Ratio	-0.57%	-1.06%	-1.49%	-1.86%	-2.15%	-2.39%

TABLE A2.3
SIMULATION : DIFFERENCES FROM BASE CASE
PRIVATE CLOSURE
HIGH INTEREST RATE

	1990	1991	1992	1993	1994	1995
GDP Growth Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Investment Growth Rate	-2.43%	0.00%	0.00%	-0.00%	-0.00%	-0.00%
Private	-3.56%	0.00%	0.00%	0.00%	0.00%	0.00%
Public	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
GDP per capita Growth Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Consumption per capita growth rate	0.53%	0.00%	0.01%	-0.00%	-0.00%	-0.00%
Gross Investment/GDP	-0.48%	-0.48%	-0.48%	-0.48%	-0.48%	-0.48%
Domestic Savings/GDP	-0.40%	-0.40%	-0.40%	-0.40%	-0.40%	-0.40%
National Savings/GDP	-0.40%	-0.39%	-0.39%	-0.38%	-0.38%	-0.38%
Marginal National Saving Rate	-10.33%	-0.29%	-0.25%	-0.28%	-0.31%	-0.29%
Private Investment/GDP	-0.48%	-0.48%	-0.48%	-0.48%	-0.48%	-0.48%
Private Consumption/GDP	0.40%	0.40%	0.40%	0.40%	0.40%	0.40%
Private Savings/GDP	0.13%	0.32%	0.46%	0.61%	0.75%	0.89%
Private Resource Balance/GDP	0.82%	0.81%	0.94%	1.09%	1.23%	1.37%
Public Investment/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Public Savings/GDP	-0.53%	-0.72%	-0.84%	-0.96%	-1.13%	-1.26%
Public Revenues/GDP	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%
Public Expenditures/GDP	0.52%	0.70%	0.83%	0.96%	1.12%	1.25%
Public Deficit/GDP	0.53%	0.72%	0.84%	0.99%	1.13%	1.26%
MLT External Financing	0.00%	0.00%	0.00%	0.00%	0.00%	0 00%
ST External Financing	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic financing-financial system	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic financing-private sector	0.53%	0.72%	0.84%	0.99%	1.13%	1.26%
Residual	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Real exchange rate index	0.00	0.00	0.00	0.00	0.00	0.00
Real Exchange Rate Depreciation(-)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic Inflation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Exchange Rate Depreciation	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nominal Interest Rate	8.99%	8.92%	8.92%	8.92%	8.92%	8.92%
Real Interest Rate	7.31%	7.31%	7.31%	7.31%	7.31%	7.31%
Government Interest Rate	8.41%	8.34%	8.34%	8.34%	8.34%	8.34%
Stock of M1/GDP	0.00%	-0.00%	0.00%	0.00%	-0.00%	-0.00%
Stock of Quasi-money/GDP	2.29%	2.29%	2.29%	2.29%	2.29%	2.29%
Stock of credit to private sector/GDP	3.82%	3.75%	3.69%	3.63%	3.59%	3.55%
Export Growth Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Growth rate manufacturing exports	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Exports/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Import Growth Rate	-0.54%	-0.00%	-0.00%	0.00%	0.00%	0.00%
Growth rate intermediate imports	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Growth rate private capital imports	-3.56%	0.00%	0.00%	0.00%	0.00%	0.00%
Growth rate private cons imports	0.61%	0.00%	0.01%	-0.01%	-0.00%	-0.00%
Imports/GDP	-0.08%	-0.08%	-0.08%	-0.08%	-0.08%	-0.08%
Current Account Deficit (in US$million)	-38	-44	-51	-59	-66	-76
Current Account Deficit/GDP	-0.08%	-0.08%	-0.08%	-0.10%	-0.10%	-0.10%
Net International Reserves (US$million)	38	83	134	193	259	335
Net Reserves (in months imports)	0.1	0.2	0.2	0.3	0.3	0.4
Total External Debt Ratio	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Public Debt Ratio	0.53%	1.14%	1.74%	2.36%	2.99%	3.62%

TABLE A2.4
SIMULATION : DIFFERENCES FROM BASE CASE
PRIVATE CLOSURE
HIGH INFLATION

	1990	1991	1992	1993	1994	1995
GDP Growth Rate	-0.00%	0.00%	0.00%	-0.00%	-0.00%	-0.00%
Investment Growth Rate	0.00%	0.00%	0.00%	-0.00%	0.00%	-0.00%
Private	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Public	0.00%	-0.00%	0.00%	-0.00%	0.00%	-0.00%
GDP per capita Growth Rate	-0.00%	0.00%	0.00%	-0.00%	-0.00%	-0.00%
Consumption per capita growth rate	-0.00%	0.00%	0.00%	0.00%	-0.00%	-0.00%
Gross Investment/GDP	0.00%	-0.00%	0.00%	0.00%	0.00%	0.00%
Domestic Savings/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
National Savings/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Marginal National Savings Rate	0.00%	0.00%	0.00%	-0.00%	0.00%	0.00%
Private Investment/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Private Consumption/GDP	-0.00%	0.00%	-0.00%	0.00%	0.00%	0.00%
Private Savings/GDP	-0.04%	-0.09%	-0.14%	-0.18%	-0.22%	-0.26%
Private Resource Balance/GDP	-0.04%	-0.09%	-0.14%	-0.18%	-0.22%	-0.26%
Public Investment/GDP	0.00%	-0.00%	0.00%	0.00%	0.00%	0.00%
Public Savings/GDP	0.04%	0.09%	0.14%	0.18%	0.22%	0.26%
Public Revenues/GDP	0.00%	-0.00%	-0.00%	0.00%	0.00%	0.00%
Public Expenditures/GDP	-0.04%	-0.09%	-0.14%	-0.18%	-0.22%	-0 26%
Public Deficit/GDP	-0.04%	-0.09%	-0.14%	-0.18%	-0.22%	-0.26%
MLT External Financing	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
ST External Financing	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic financing-financial system	0.14%	0.17%	0.17%	0.17%	0.17%	0.17%
Domestic financing-private sector	-0.19%	-0.27%	-0.31%	-0.36%	-0.40%	-0.43%
Residual	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Real exchange rate index	0.00	0.00	0.00	0.00	0.00	0.00
Real Exchange Rate Depreciation(-)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Domestic Inflation	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
Exchange Rate Depreciation	4.74%	5.69%	5.69%	5.69%	5.69%	5.69%
Nominal Interest Rate	6.13%	6.16%	6.16%	6.16%	6.16%	6.16%
Real Interest Rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Government Interest Rate	-0.00%	-0.00%	-0.00%	-0.00%	-0.00%	-0.00%
Stock of M1/GDP	-0.11%	-0.13%	-0.13%	-0.13%	-0.13%	-0.13%
Stock of Quasi-money/GDP	-0.00%	0.00%	0.00%	0.00%	-0.00%	-0.00%
Stock of credit to private sectur/GDP	0.01%	0.08%	0.19%	0.31%	0.38%	0.42%
Export Growth Rate	0.00%	0.00%	0.00%	-0.00%	0.00%	0.00%
Growth rate manufacturing exports	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Exports/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Import Growth Rate	0.00%	-0.00%	0.00%	0.00%	-0.00%	0.00%
Growth rate intermediate imports	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Growth rate private capital imports	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Growth rate private cons imports	-0.00%	0.00%	0.00%	-0.00%	-0.00%	0.00%
Imports/GDP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Current Account Deficit (in US$million)	0	-0	-0	-0	-0	-0
Current Account Deficit/GDP	0.00%	-0.00%	-0.00%	-0.00%	-0.00%	-0.00%
Net International Reserves (US$million)	0	0	0	0	0	0
Net Reserves (in months imports)	0.0	0.0	0.0	0.0	0.0	0.0
Total External Debt Ratio	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Public Debt Ratio	-0.28%	-0.64%	-0.96%	-1.26%	-1.53%	-1.78%

BIBLIOGRAPHY

Easterly, William (1989), "A Consistency Framework for Macroeconomic Analysis," PPR Working Paper 234, June 1989.

_____ and Deborah Wetzel (1989), "Policy Determinants of Growth: Survey of Theory and Evidence," PPR Work Paper No. 343, December 1989.

Holsen, John (1989), "KENYA.MOD: A Simplified Example of RMSM-X," mimeo, May 1989.

Khadr, Ali and Klaus Schmidt-Hebbel (1989), "A Framework for Macroeconomic Consistency for Zimbabwe," PPR Working Paper 310, December 1989.

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